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Edexcel GCE

Biology
Advanced Subsidiary
Unit 2: Development, Plants and the Environment

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|--|-------------------------------------|
| Monday 3 June 2013 – Morning Time: 1 hour 30 minutes | Paper Reference 6BI02/01R |
|--|-------------------------------------|

You do not need any other materials.

| |
|-------------|
| 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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PEARSON

SECTION A

Answer ALL questions.

Some questions must be answered with a cross ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 A student investigated three different cells: an animal cell, a bacterial cell and a plant cell. She made several observations.

(a) Read through the following passage describing the student’s observations. Write the most appropriate word or words on the dotted lines to complete the passage.

(7)

The plant cell and the cell possess a nucleus containing chromosomes.

Only the cell and the plant cell have a cell wall but all three cells have a cell

Centrioles are present only in the cell and amyloplasts are found only in the cell. Mitochondria and rough endoplasmic reticulum are not present in the cell. All these cells contain structures called which are involved in the synthesis of protein.



(b) The cell wall of the plant cell contains cellulose molecules.

Complete the table by placing a cross in the appropriate box (☒) to indicate if each statement is true or false.

(4)

| A cellulose molecule contains | True | False |
|-------------------------------|------|-------|
| Beta (β) glucose | ☒ | ☒ |
| 1,4-glycosidic bonds | ☒ | ☒ |
| 1,6-glycosidic bonds | ☒ | ☒ |
| Magnesium atoms | ☒ | ☒ |

(Total for Question 1 = 11 marks)



- 2 In 1785, William Withering published his findings into the use of foxglove plants in the treatment of patients with heart disease. He made an extract from foxglove plants, gave it to people with heart disease and observed its effects. This is no longer allowed by law.



Foxglove flowers

Magnification $\times 0.5$

- (a) New drugs can be developed from plant extracts.

Describe and explain the procedures that must be followed **before** these drugs can be tested on patients.

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(b) Explain how a **double blind trial** is used to test a new drug.

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(Total for Question 2 = 7 marks)



3 The photograph below shows a plant cell undergoing mitosis.



Magnification $\times 100$

(a) (i) Place a cross in the box () next to the stage of mitosis shown in the photograph.

(1)

- A** interphase
- B** metaphase
- C** prophase
- D** telophase

(ii) Explain the reason for your answer.

(2)

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(b) Place a cross in the box () which correctly identifies the stage in which DNA is replicated.

(1)

- A** anaphase
- B** interphase
- C** metaphase
- D** telophase



*(c) Describe what happens inside an animal cell as it undergoes the last stage of mitosis and forms two new cells.

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(Total for Question 3 = 8 marks)



4 Fertilisation in flowering plants starts with the growth of a pollen tube.

- (a) An investigation was carried out to study the effect of cycloheximide (CH) on the growth of pollen tubes from pollen. Samples of pollen grains were obtained from *Impatiens glandulifera* (Himalayan balsam).



Impatiens glandulifera

Magnification $\times 0.5$

The pollen samples were exposed to different concentrations of CH.

After one hour, the lengths of the pollen tubes in each sample were measured. A control experiment was also carried out without CH. The results are shown in the table below.

| Cycloheximide (CH) concentration / $\mu\text{g cm}^{-3}$ | Mean pollen tube length after 1 hour / μm |
|--|--|
| 0 (control) | 603 |
| 1 | 625 |
| 10 | 678 |
| 50 | 639 |
| 100 | 619 |
| 200 | 543 |

- (i) Suggest why the temperature was kept constant throughout this investigation. Give an explanation for your answer.

(2)

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(ii) Use the information in the table to describe the effect of cycloheximide (CH) concentration on the growth of pollen tubes.

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(iii) In the control, after two hours, all the pollen tubes contained gametes.

After two hours in the presence of cycloheximide (CH), none of the pollen tubes contained gametes.

Suggest which process in pollen grains could be inhibited by cycloheximide (CH).

(1)

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*(b) Describe the process of fertilisation that takes place in flowering plants.

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(c) Explain how meiosis produces genetic variation in gametes.

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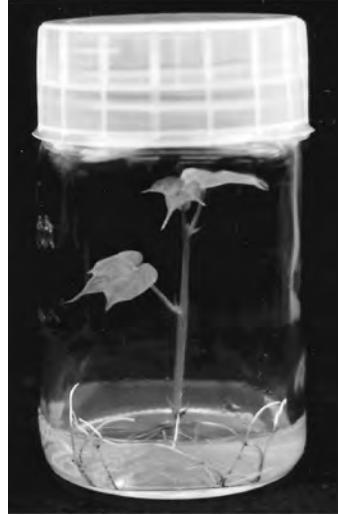
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(Total for Question 4 = 12 marks)



5 Plant tissue culture is a technique that can be used to grow large numbers of genetically identical plants. Scientists have used plant tissue culture techniques to produce large numbers of cotton plants. Cotton plants provide fibres used for clothing.



Cotton plant grown by plant tissue culture
Magnification $\times 1$

(a) Suggest why the sample tube, shown in the photograph, is sealed.

(2)

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(b) Explain why the cotton plants that are produced are genetically identical.

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(c) The effect of two synthetic plant growth substances, 6-benzylaminopurine (BAP) and 1-naphthalene acetic acid (NAA), on shoot growth was investigated.

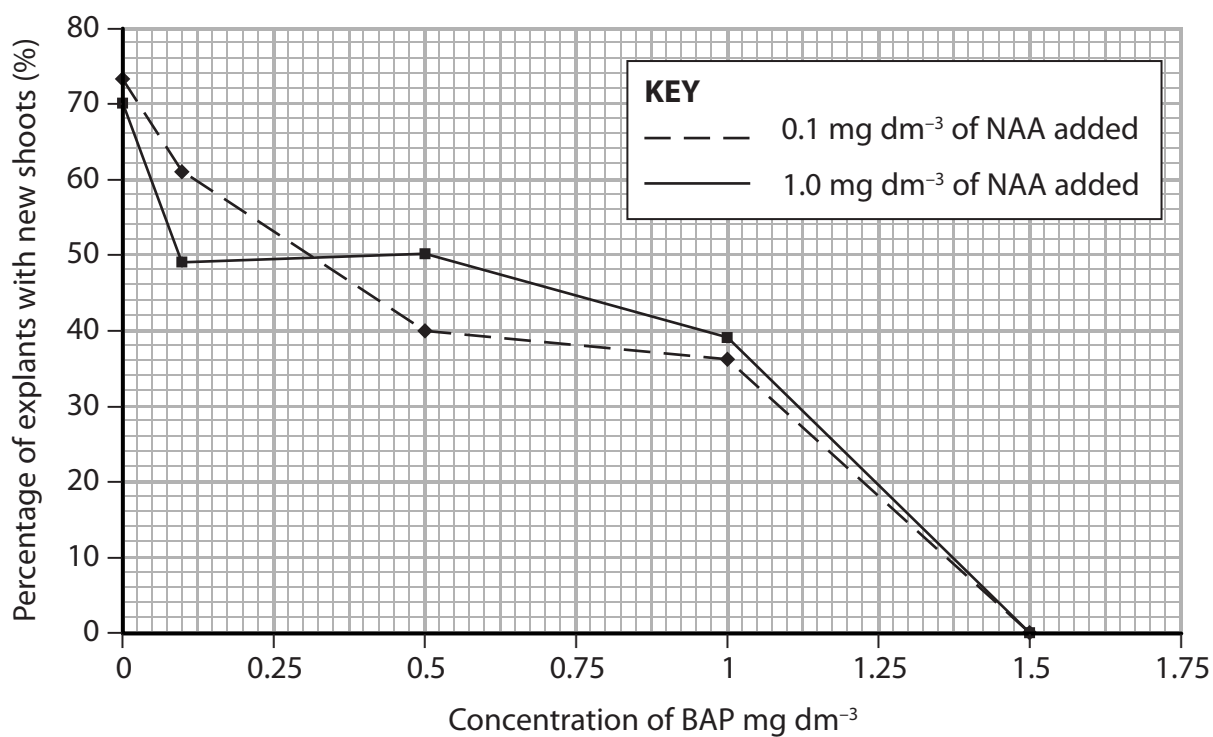
Scientists took samples of tissue, called explants, from cotton plant seedlings that were three days old. These explants were placed on agar in Petri dishes.

The agar contained 0.1 mg dm^{-3} NAA and a range of concentrations of BAP.

The percentages of explants that successfully developed new shoots were recorded.

This was repeated with agar containing 1.0 mg dm^{-3} NAA and the same range of BAP concentrations.

The results are shown in the graph below.



(i) For the explants grown on agar containing 0.1 mg dm^{-3} NAA, describe the effect of increasing BAP concentration on the percentage of explants that developed new shoots.

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(ii) The scientists concluded that NAA had little effect on the percentage of explants that developed new shoots. Discuss the validity of this conclusion.

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(d) Name the property of the cells in the explant tissue which allows them to develop into new shoots.

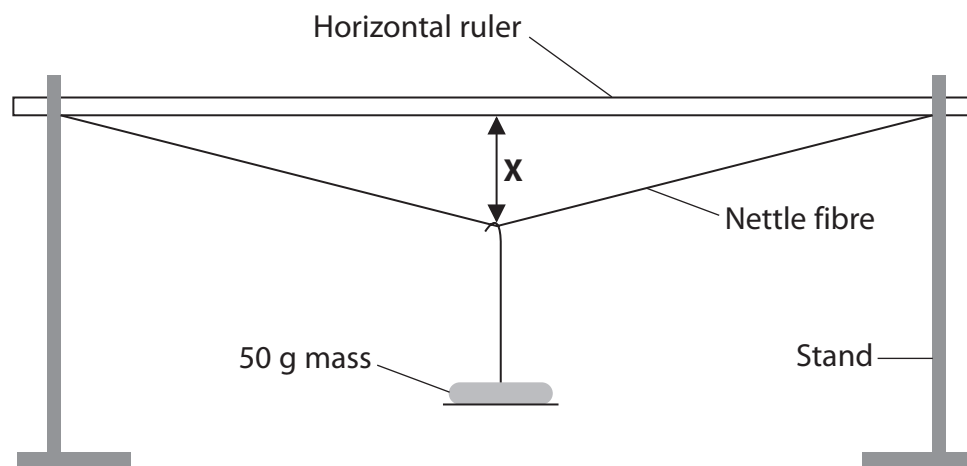
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(Total for Question 5 = 11 marks)



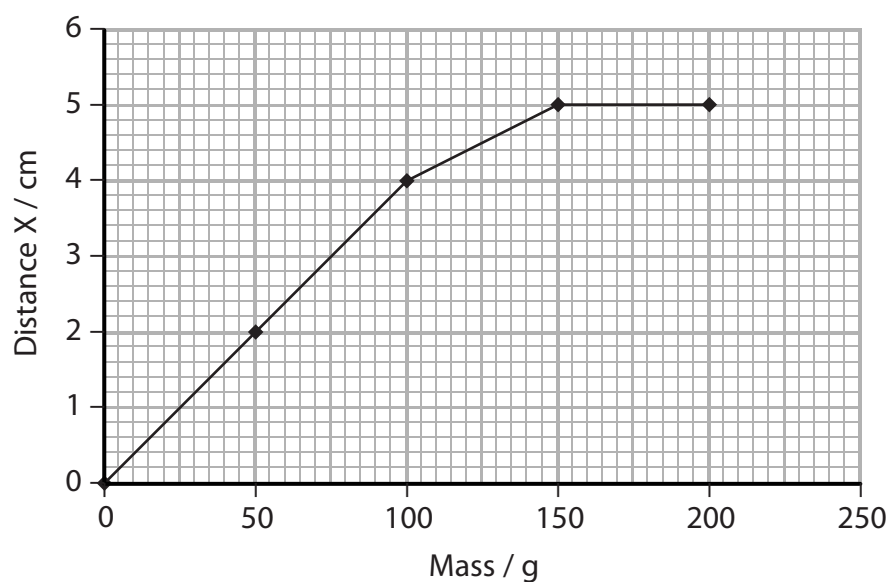
- 6 A student carried out a study to investigate the tensile strength of fibres extracted from nettle plants, using the equipment below.



The student attached the plant fibre to two stands so that it was touching the horizontal ruler. She then added a 50 g mass to the middle of the fibre and measured distance **X**.

She repeated this by adding additional 50 g masses. The fibre broke when the total mass added was 250 g.

The results are shown in the graph below.



(a) Using the information in the graph, describe the effect on distance **X** of increasing the mass.

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(b) She repeated the experiment with a second fibre and gained a different set of results. These are shown in the table below.

| Mass / g | Distance X / cm |
|----------|-----------------|
| 0 | 0 |
| 50 | 4 |
| 100 | 5 |
| 150 | 7.5 |
| 200 | Fibre broke |

Suggest and explain a reason for the difference in the results obtained.

(2)

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(c) Describe how you could use the equipment in this experiment to compare the tensile strength of nettle fibres with that of nylon fibres.

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(Total for Question 6 = 10 marks)



7 The scientist Carl Woese suggested that living organisms could be grouped into three domains. There are specific differences between the organisms in the three domains.

(a) Place a cross in the box (☒) that correctly identifies the names of the three domains suggested by Woese.

(1)

- A Animalia, Archaea and Eukarya
- B Animalia, Bacteria and Prokaryotae
- C Archaea, Bacteria and Eukarya
- D Archaea, Eukarya and Prokaryotae

(b) Carl Woese's ideas were not accepted when he first suggested that every organism could be classified into one of three domains.

(i) Suggest **two** ways in which Woese communicated his findings to the scientific community.

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(ii) Describe how the scientific community would have evaluated Woese's theory.

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(c) Woese suggested that organisms could be placed in taxonomic groups based on molecular phylogeny. Explain what is meant by this statement.

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(Total for Question 7 = 9 marks)



8 The Mount Graham squirrel, *Tamiasciurus hudsonicus grahamensis*, is endemic to Graham Mountain in Arizona, USA.

In 2011 its habitat was threatened by wildfires. Two males and two females were taken from the wild by conservation workers from Phoenix Zoo.



Mount Graham squirrel
Magnification $\times 0.1$

(a) Place a cross in the box () that correctly describes what is meant by the term **endemic species**.

(1)

- A a species found in all countries
- B a species found in all habitats
- C a species found in one geographical location
- D a species found in one type of habitat

(b) Suggest the problems the zoo might have in trying to develop a breeding programme with these Mount Graham squirrels.

(3)

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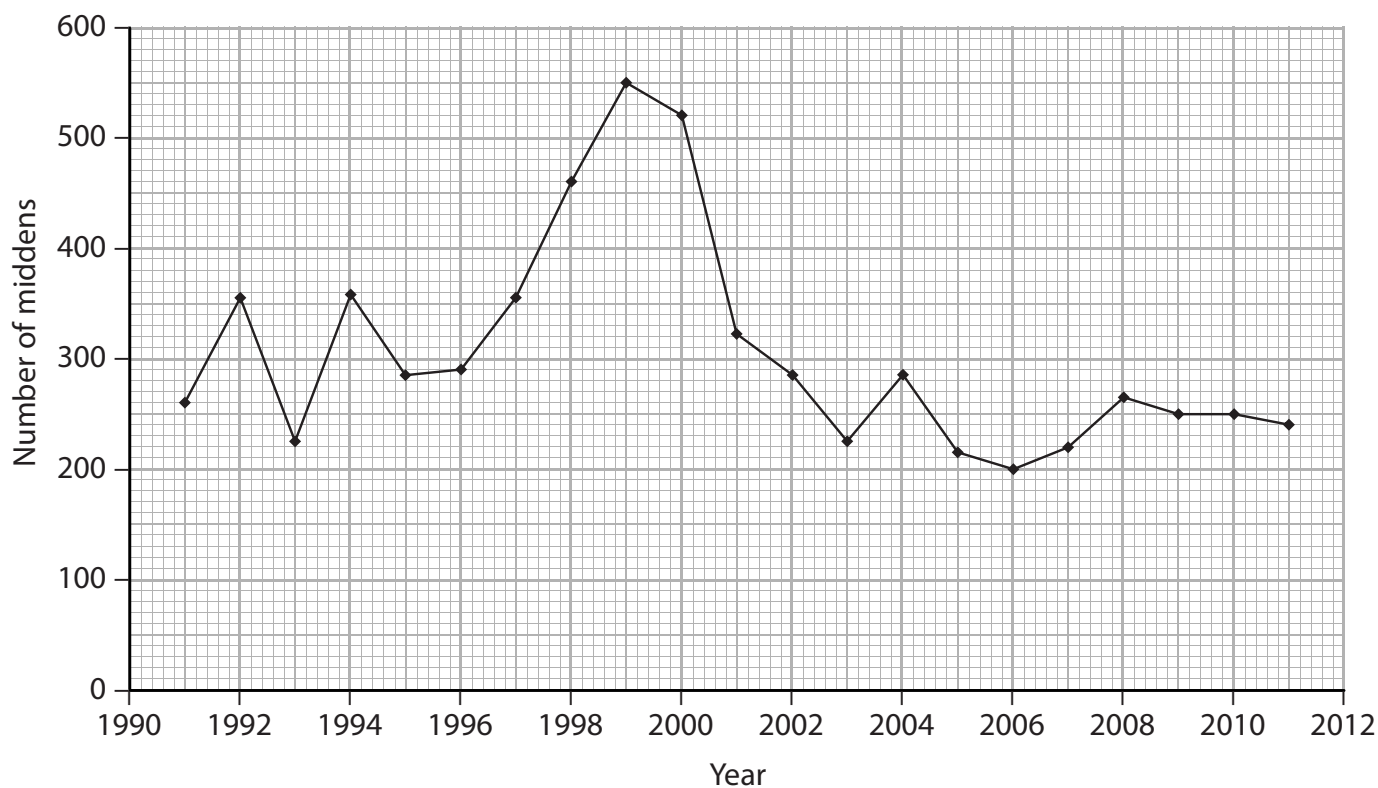
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(c) Squirrels bury food, such as seeds and nuts, in areas called middens.

The population size of Mount Graham squirrels in the wild is estimated by surveying the number of middens.

The graph below shows the results of surveys carried out from 1991 to 2011.



(i) Using the information in the graph, calculate the percentage change in the number of middens from 1999 to 2006. Show your working.

(3)

Answer%



(ii) Using information in the graph, suggest what happened to the population size of the Mount Graham squirrel between 1999 and 2006.

(2)

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(d) Suggest and explain why it was decided to develop a captive breeding programme for the Mount Graham squirrel.

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(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS





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