Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 2: Development, Plants and the Environment

Tuesday 19 January 2010 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
6BI02/01

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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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 All organisms are made up of one or more cells.

(a) For each of the descriptions below, put a cross ☒ in the box that corresponds to the correct statement about the features of animal, plant and prokaryotic cells.

(6)

(i) Genetic material is

☒ **A** separate strands in animal and prokaryotic cells

☒ **B** separate strands in animal and plant cells

☒ **C** circular in animal and prokaryotic cells

☒ **D** circular in animal and plant cells

(ii) Centrioles are present in

☒ **A** plant cells only

☒ **B** animal cells only

☒ **C** prokaryotic cells only

☒ **D** animal, plant and prokaryotic cells

(iii) The cell surface membrane is present in

☒ **A** plant cells only

☒ **B** animal cells only

☒ **C** prokaryotic cells only

☒ **D** animal, plant and prokaryotic cells

(iv) Pits are found in the cell walls of

☒ **A** plant cells only

☒ **B** prokaryotic cells only

☒ **C** plant and prokaryotic cells

☒ **D** animal, plant and prokaryotic cells

(v) The tonoplast may be present in

☒ **A** plant cells only

☒ **B** prokaryotic cells only

☒ **C** plant and prokaryotic cells

☒ **D** animal, plant and prokaryotic cells

(vi) Cell walls are found in

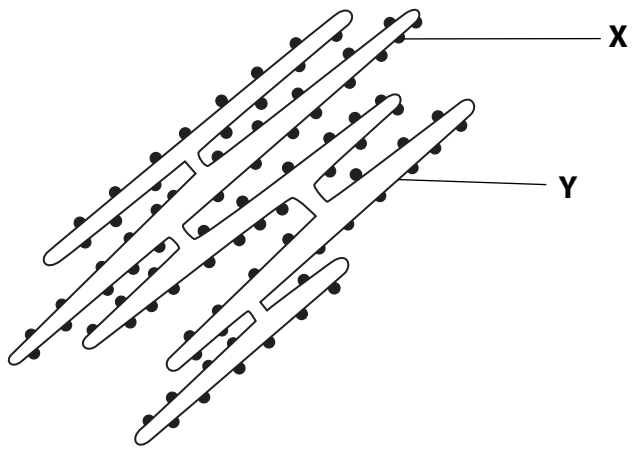
☒ **A** plant cells only

☒ **B** prokaryotic cells only

☒ **C** plant and prokaryotic cells

☒ **D** animal, plant and prokaryotic cells

(b) The diagram below shows a structure found in the cytoplasm of both plant and animal cells, as seen using an electron microscope.



(i) Name the structure shown in the diagram.

(1)

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(ii) Name the parts labelled **X** and **Y**.

(2)

X .....

Y .....

(Total for Question 1 = 9 marks)

2 The phenotype of an organism is affected by its genotype and its environment.

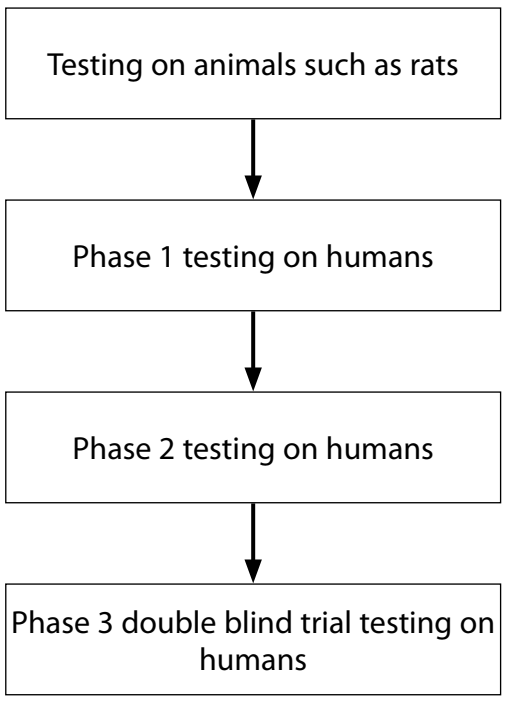
(a) The table below shows the mean difference in two phenotypes, height and mass, from a study on several human identical twins and non-identical twins. Each pair of twins was brought up together.

	Type of twins	
Phenotype	**Identical**	**Non-identical**
Mean height difference / cm	1.7	4.4
Mean mass difference / kg	1.9	4.6

Explain how the data in the table show the effects that genotype and the environment have on the phenotypes.

(3)

(b) When a drug is being developed, it goes through a series of different test stages.
Some of these are shown below.



(i) Suggest why a drug can be tested on rats before testing on humans.

(2)

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(ii) State what is done during each of the following phases of testing on humans.

(3)

Phase 1 .....

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Phase 2 .....

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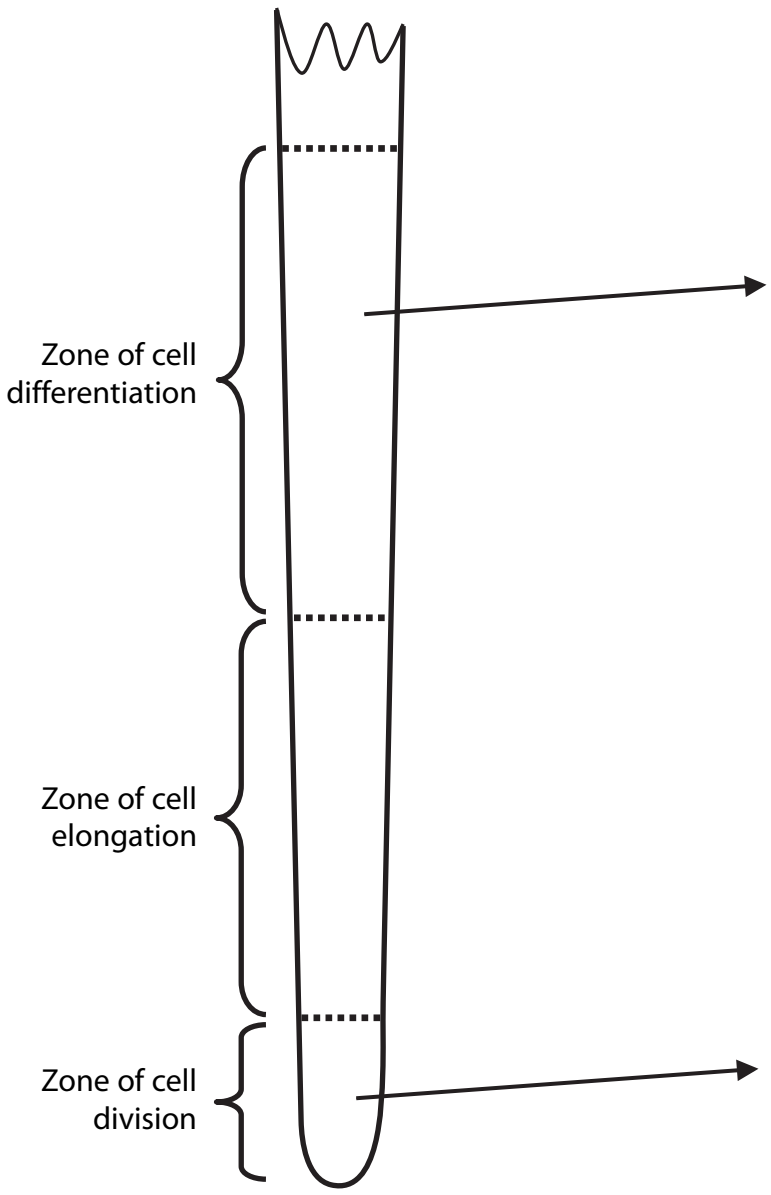
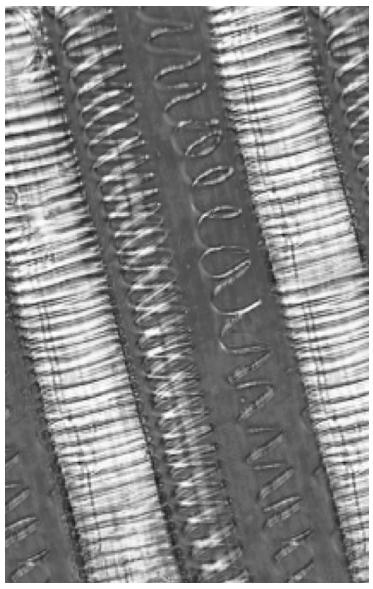
(Total for Question 2 = 8 marks)

3 In the roots of plants, cell division, cell elongation (growth) and cell differentiation occur in different zones near the root tip.

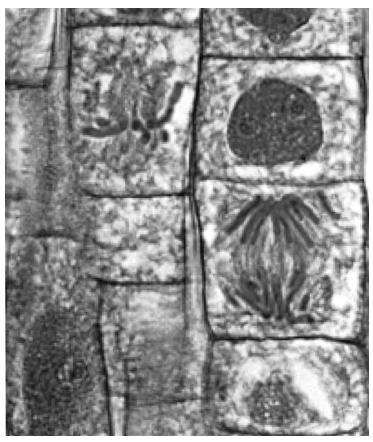
The diagram below show the three different zones in a root. Photographs **A** and **B** show some of the tissues present in two of these zones.



Photograph A



Photograph B



(a) (i) Name the specialised tissue shown in photograph **A**.

(1)

*(ii) Describe and explain how this tissue is adapted for the transport of water and support in a plant.

(4)

(b) Explain how differential gene expression could result in the specialisation of cells.

(3)

(c) Only one of the two tissues shown in the photographs **A** and **B** is totipotent. Describe how you could use a plant tissue culture technique to show which of the two tissues is totipotent.

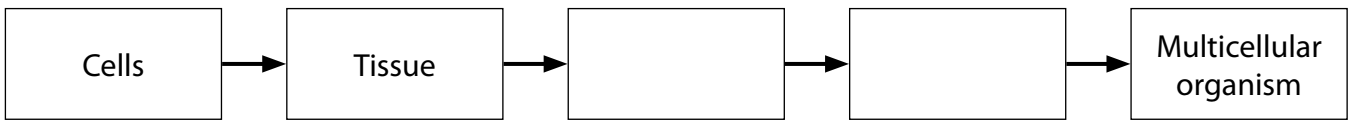
(4)

(Total for Question 3 = 12 marks)

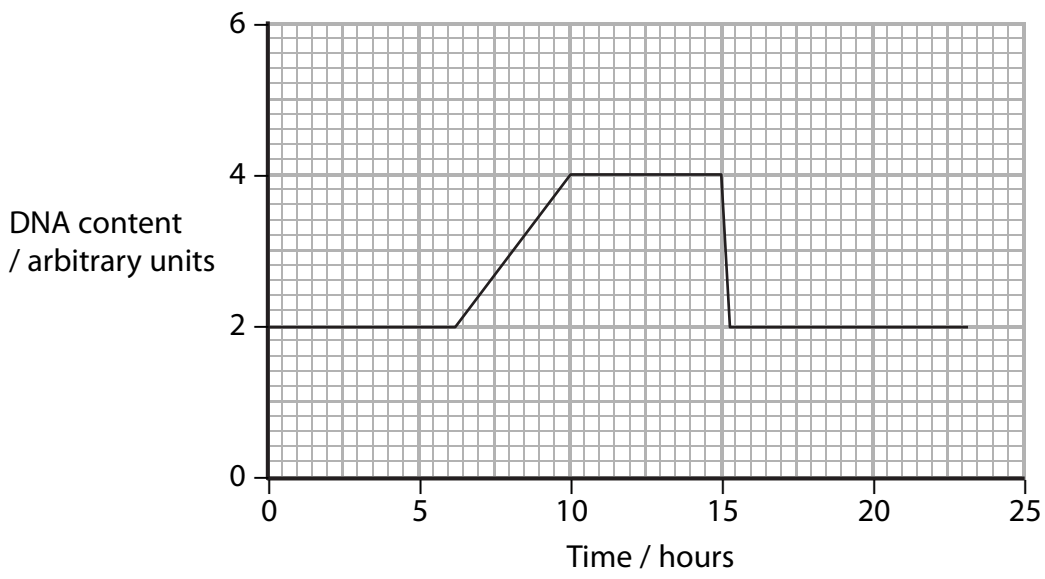
4 Cell division produces more cells. Groups of cells become organised into tissues and further organisation results in the formation of a multicellular organism.

(a) Complete the diagram below by writing in the boxes the missing levels of organisation in the correct order.

(2)



(b) The graph below shows the changes in the DNA content of an onion cell, during one cell cycle.



(i) Explain why the DNA content of the cell doubles.

(2)

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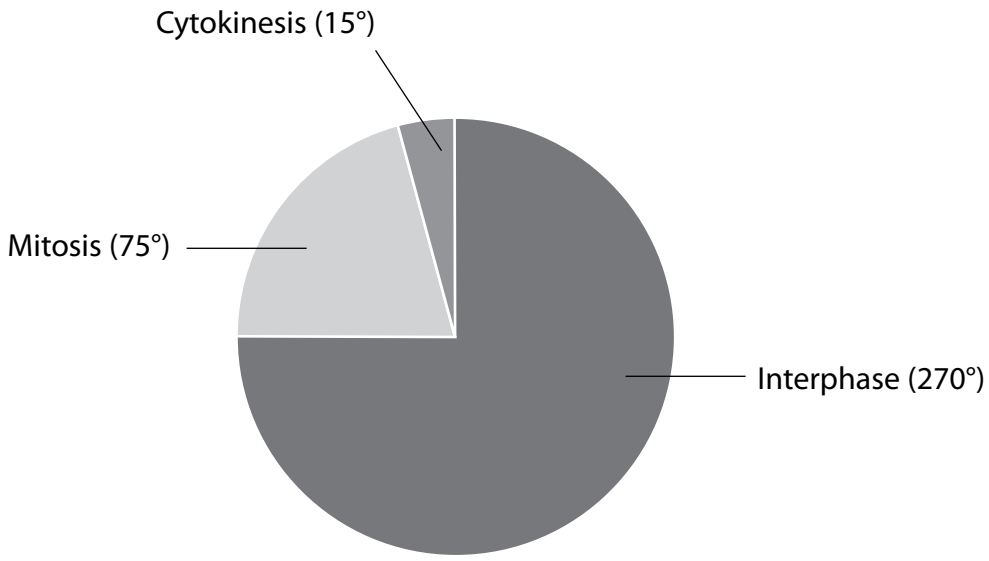
(ii) Using the graph, state how long the S phase (DNA synthesis) takes.

(1)

..... hours

(iii) In onion cells, interphase lasts an average of 18 hours. Using this information and the diagram below, calculate how long mitosis takes. The figures in brackets show the number of degrees for each sector of the circle. Show your working.

(2)



Answer ..... hours

*(c) Prophase is a stage in mitosis. Describe the events that occur during prophase.

(3)

(Total for Question 4 = 10 marks)

5 Meiosis is involved in producing gametes such as sperm cells and egg cells.

(a) Describe **three** structural differences between a human sperm cell and a human egg cell.

(3)

1 .....

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2 .....

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3 .....

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(b) When a sperm cell reaches an egg cell, enzymes are released from the head of the sperm. Explain the reasons for the release of these enzymes.

(2)

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(c) Describe what happens in the egg cell once the sperm cell nucleus has entered it.

(2)

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(d) In plants, a double fertilisation occurs.

(i) One fertilisation involves a male gamete nucleus fusing with the egg cell nucleus. Give **two** functions of this fertilisation.

(2)

1 .....

.....

2 .....

.....

(ii) In the second fertilisation, the other male gamete nucleus fuses with two polar nuclei forming a triploid structure. Name the triploid structure formed.

(1)

.....

(Total for Question 5 = 10 marks)

6 The diversity of ant species in a habitat can be used as an indicator of environmental conditions and conservation status.

(a) A study of the effect of high copper levels on ant diversity was undertaken in Brazil. Ants were collected in the same way at three different sites in one habitat. The number of different species at each site was recorded. Site 1 and Site 2 were near a copper mine and had high levels of copper present. Site 3 had normal levels of copper. The amount of vegetation present at each site was also recorded.

The results are shown in the table below.

Site	Number of ant species found	Amount of vegetation present
1	14	Very little
2	16	Little
3	45	Rich and dense

(i) Using the information in the table, what is the evidence that ant diversity can be used as an indicator of environmental conditions?

(1)

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(ii) It has been suggested that there is no **direct** effect of copper on ants. Suggest how the data in the table support this suggestion.

(2)

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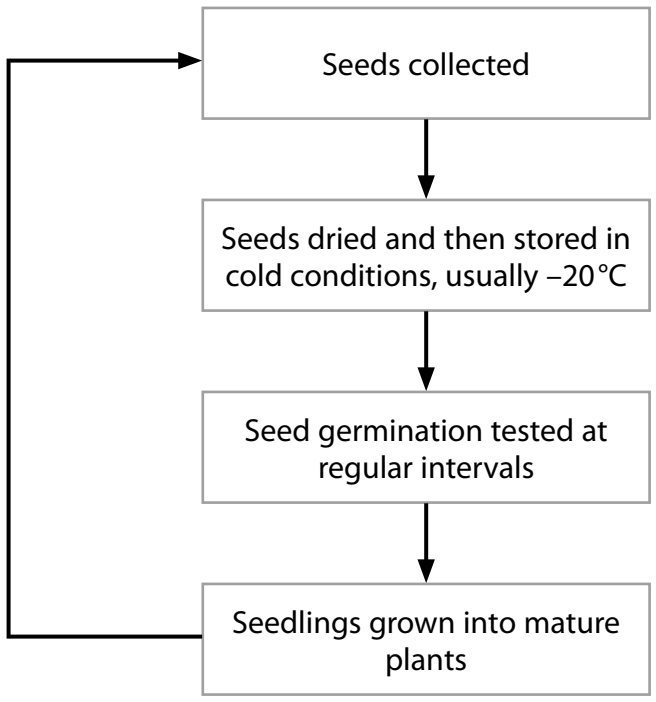
(b) Seedbanks have been set up around the world to help conserve rare plant species.
The process for storing seeds includes the following stages.



(i) Suggest **two** reasons why the seeds need to be dried and then stored in cold conditions.

(2)

1 .....

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2 .....

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(ii) Suggest why seed germination is tested at regular intervals.

(2)

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(c) One of the aims of both seedbanks and zoos is to conserve endangered species.

Give **two** ways in which zoos help to conserve endangered species.

(2)

1 .....

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2 .....

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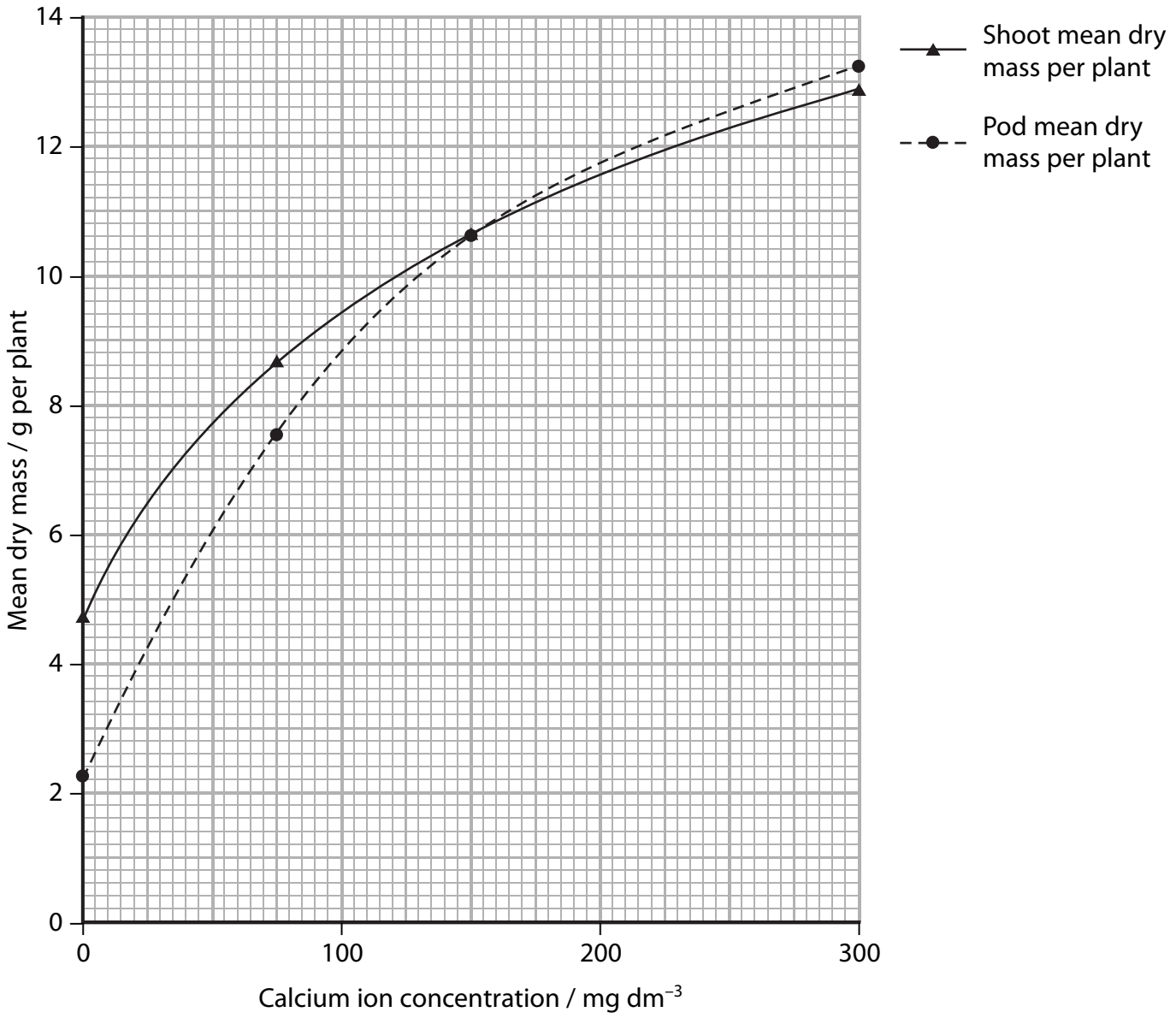
(Total for Question 6 = 9 marks)

7 A study was undertaken to investigate the effect of calcium ion concentration on the mass of shoots and the mass of pods of bean plants.

Two bean plants were grown in a pot and watered regularly with a solution containing all the required mineral ions except calcium. When the plants had produced mature bean pods, the shoots and the pods were dried and the mean dry masses were recorded.

This experiment was repeated three times, each with a different calcium ion concentration added to the watering solution.

The results are shown in the graph below.



(a) (i) Using the information in the graph, compare the effect of calcium ion concentration on the mean dry mass of shoots and the mean dry mass of pods in bean plants.

(3)

(ii) Suggest how calcium ions contributed to the change in mass in the shoot of the bean plant.

(1)

(b) During this investigation, it was found that there was a relationship between calcium ion concentration in the watering solution and total nitrogen uptake by the bean pods. The data are shown below.

Calcium ion concentration in the watering solution / mg dm^{-3}	**Total nitrogen uptake by the bean pods / mg**
0	70
75	220
150	290
300	350

(i) Describe the relationship between calcium ion concentration and total nitrogen uptake by the bean pods.

(2)

(ii) Suggest the form in which the nitrogen was supplied in the watering solution.

(1)

*(iii) Suggest how the protein content of the bean pods from plants grown in the watering solution containing a calcium ion concentration of 300 mg dm^{-3} would differ from those watered with a lower calcium ion concentration.

Give an explanation for your answer.

(3)

(Total for Question 7 = 10 marks)

8 A student investigated the antimicrobial properties of tea tree oil.

She cut three identical discs of blotting paper. She soaked disc 1 in 100% tea tree oil, disc 2 in 50% tea tree oil and 50% vegetable oil and disc 3 in 100% vegetable oil. She then placed all three discs onto a single suitably-prepared Petri dish as shown in diagram 1.

She incubated the Petri dish at 25 °C for 24 hours. The results of the incubation are shown below in diagram 2.

Diagram 1

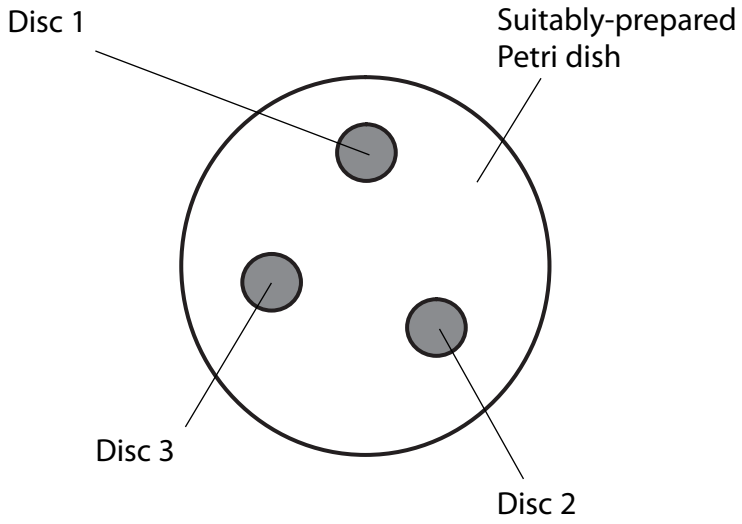
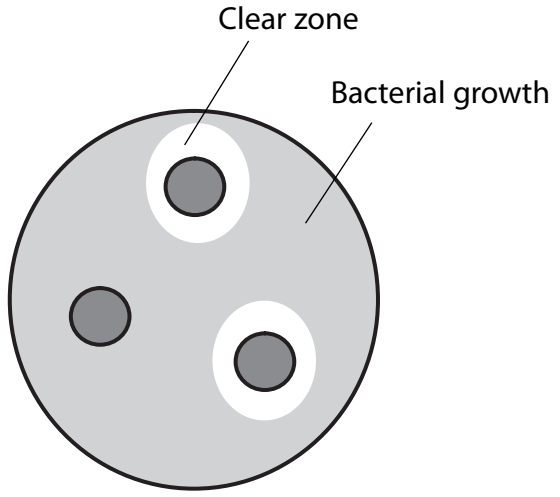


Diagram 2



(a) Suggest what is meant by the phrase **suitably-prepared Petri dish**.

(2)

(b) (i) Describe the function of disc 3.

(1)

(ii) Explain why clear zones are found around disc 1 and disc 2.

(2)

(iii) The clear zone around disc 1 is not a circle. Suggest how you would calculate the mean diameter of this clear zone.

(2)

QUESTION 8 CONTINUES ON THE NEXT PAGE

(c) The mean diameters of the clear zones around disc 1 and disc 2 were found to be the same. This suggests that both strengths of tea tree oil had equally effective antimicrobial properties.

Describe how you would determine the minimum strength of tea tree oil that would be as effective as the 100% tea tree oil.

(3)

(d) Suggest **one** reason why it was good safety practice to incubate the Petri dish at 25 °C rather than at 37 °C.

(2)

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS