Plant Cells

Question Paper 1

Level	International A Level
Subject	Biology
Exam Board	Edexcel
Topic	Plant structure and function, Biodiversity and Conservation
Sub-Topic	Plant cells
Booklet	Question paper 1

Time Allowed: **70 minutes**

Score: **/58**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1 Plant cell walls are formed as cells divide and develop.

(a) Read through the following passage about plant cell walls.
Write on the dotted lines the most appropriate word or words to complete the passage.

(4)

Plant cell walls contain cellulose, a polymer consisting of ..... monomers.

The monomers of this polymer are held together by ..... bonds.

Groups of cellulose molecules are held together by ..... bonds to form ..... that become part of the cell wall.

(b) The table below shows the chemical composition of fibres from five different plant sources.

Source of fibre	Chemical composition of fibres / arbitrary units		
	Cellulose	**Lignin**	**Pectin**
Flax	75	4	7
Jute	70	12	1
Cotton	95	0	4
Wheat	43	18	4
Wood		25	0

Using the information in the table and your own knowledge, suggest which source produces the weakest fibres. Give a reason for your answer.

(2)

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(c) The photograph below shows a wheat plant.

Magnification ×0.1

Calcium ion deficiency in wheat plants can affect the development of the cell wall. This results in slower growth of wheat plants and reduces the final mass of grain produced (crop yield).

(i) Explain the role of calcium ions in the structure of cell walls in plants.

(2)

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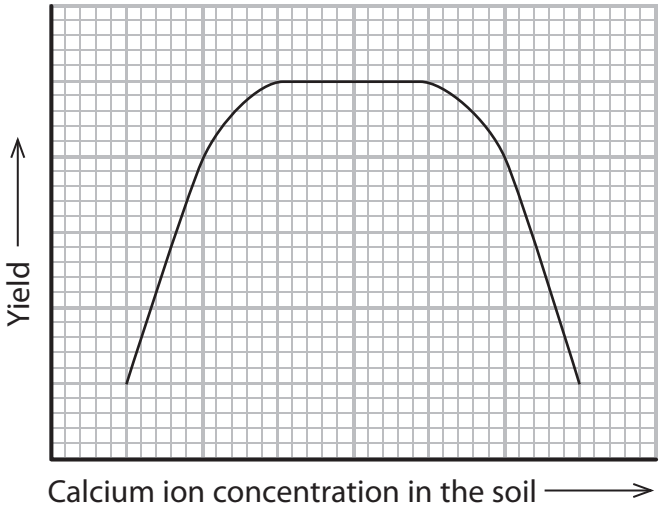
*(ii) The yield of crop plants, such as wheat, is affected by the calcium ion concentration in the soil. This is shown in the graph below.



Describe how to carry out an investigation to determine the concentration of calcium ions needed for the maximum yield of grain from wheat plants.

(5)

(Total for Question 1 = 13 marks)

2 The photograph below shows date palm plants in the United Arab Emirates.

Magnification ×0.01

Date palms are either female or male, but only the female plants produce fruit.

It is not possible to determine whether the plants are female or male until they are at least seven years old.

Tissue culture techniques have been used to produce large numbers of female date palms. These techniques also allow for the production of plants that are resistant to pests and disease and produce good quality dates.

(a) (i) Explain how tissue culture techniques can be used to produce only female date palms.

(2)

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(ii) Suggest why it would be necessary to grow some male date palms.

(1)

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(b) The table below shows some of the stages in the production of date palm plants by tissue culture, using explants.

Explants are small samples of plant tissue.

Stage	Description of stage
1	Explants removed from leaf buds of mature plants
2	Surfaces of explants sterilised
3	Explants placed in containers of sterile growth medium with growth regulators
4	Sealed containers placed under banks of lights
5	Cells in explants multiply
6	Shoots and roots develop and a whole plant is produced

(i) Explain how contamination of the explants is prevented.

(2)

(ii) Explain why contamination of the explants must be prevented.

(2)

At stage 3, the plant growth regulator 2,4-D is used.

The table below shows the effects of 2,4-D on the development of shoots by date palm explants.

Concentration of 2,4-D / mg dm^{-3}	Percentage of explants developing shoots (%)
0.3	47
1.0	53
3.0	53
10.0	53
30.0	67
100.0	13
300.0	6

(iii) Using information in the table, describe the effect of 2,4-D concentration on the development of shoots.

(3)

(c) Explain the role of the cell cycle in tissue culture.

(2)

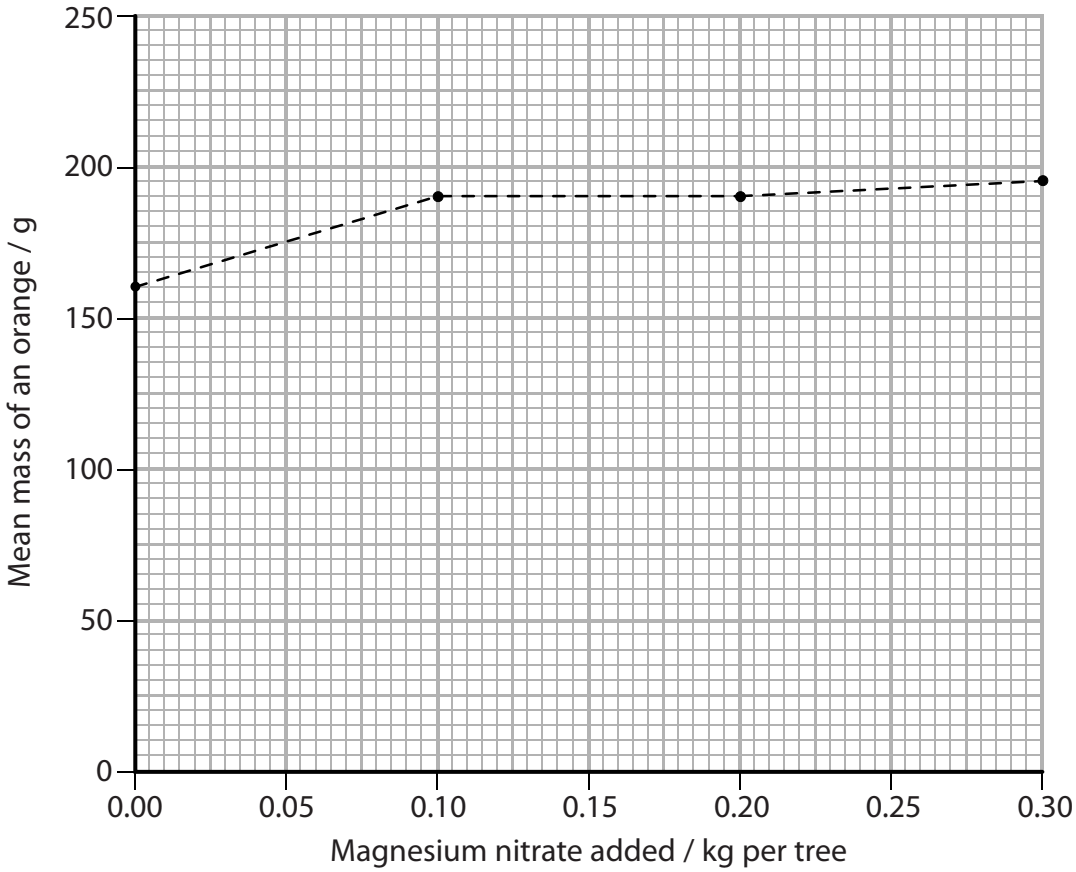
(Total for Question 2 = 12 marks)

3 Citrus fruit, such as oranges, are grown in sandy soils in warm climates. Sandy soils are often deficient in mineral ions.

(a) In Egypt, the effect of adding magnesium nitrate to sandy soil was investigated.

(i) The number of oranges produced by each tree and the mass of each orange were recorded. The mean mass of an orange from each tree was calculated.

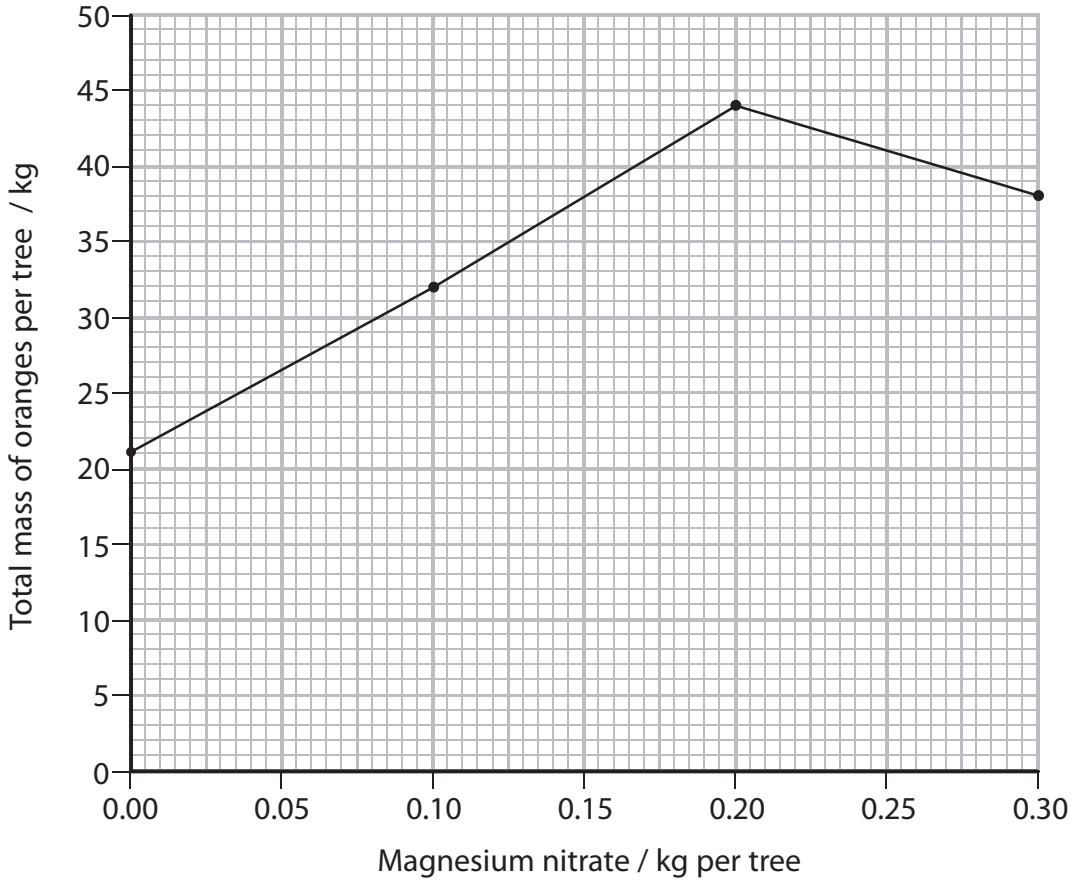
The results are shown in the graph below.



Using information in the graph, describe the effect of adding magnesium nitrate on the mean mass of oranges.

(2)

(ii) The total mass of oranges produced by each tree is shown in the graph below.



Using the information in the graph, calculate the maximum percentage increase in the total mass of oranges produced.

Show your working.

(3)

.....%

(iii) Using the information in both graphs, suggest why the following statement may not be valid.

'The optimum mass of magnesium nitrate for orange trees is 0.2 kg per tree.'

(2)

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(b) Suggest why the addition of magnesium nitrate affected the production of oranges.

(4)

(c) When orange trees are grown in sandy soil they may need to be given extra water. Give **two** reasons why plants need water.

(2)

1 .....

2 .....

(Total for Question 3 = 13 marks)

4 Cellulosic ethanol is a biofuel. It is produced from parts of crop plants that cannot be eaten, such as wood and wheat straw.

This ethanol is made by fermenting the monosaccharide sugar produced when cellulose is broken down.

(a) For each of the following statements place a cross ☒ in the box next to the correct answer.

(i) The monosaccharide sugar produced when cellulose is broken down is

(1)

☒ **A** α glucose

☒ **B** β glucose

☒ **C** fructose

☒ **D** maltose

(ii) The types of bond that would have to be broken down in the cellulose are

(1)

☒ **A** 1-4 glycosidic bonds only

☒ **B** 1-6 glycosidic bonds only

☒ **C** hydrogen bonds and 1-4 glycosidic bonds

☒ **D** hydrogen bonds and 1-6 glycosidic bonds

(b) Explain why the use of this biofuel is more sustainable than using fossil fuels.

(3)

(c) This biofuel is produced from lignocellulose, a structural material containing cellulose and lignin.

Suggest **one** type of plant tissue that would be a source of the lignocellulose.

Give an explanation for your answer.

(3)

Type of plant tissue .....

Explanation .....

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(Total for Question 4 = 8 marks)

5 Oak trees may be found growing in gardens and woods.

During sexual reproduction in oak trees, pollen is transferred between the flowers. The flowers then produce nuts called acorns. An acorn contains the embryo plant, as well as a store of starch.

The photograph below shows oak leaves and acorns.

Magnification $\times 1$

(a) (i) Describe how the pollen is involved in the production of the embryo plant.

(4)

(ii) Explain why starch is a suitable molecule to be stored in the acorn.

(4)

(b) Some oak trees lose their leaves each year. The leaves remain on the ground because they take a long time to decompose.

The leaves contain high levels of tannins that are poisonous to many animals and microorganisms.

Explain why oak tree leaves take a long time to decompose.

(4)

(Total for Question 5 = 12 marks)