Write your name here

Surname	Other names

Pearson Edexcel GCE

Centre Number	Candidate Number

Biology

Advanced Subsidiary
Unit 2: Development, Plants and the Environment

Monday 2 June 2014 – Afternoon
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

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 Mammalian gametes have specialised structures related to their function.

(a) The table below lists features found in egg cells and sperm cells. Complete the table by placing a cross (☒) in the appropriate box.

(4)

Feature	Egg cell only	Sperm cell only	Both egg cell and sperm cell	Neither egg cell nor sperm cell
Acrosome	☒	☒	☒	☒
Cortical granules	☒	☒	☒	☒
Flagellum	☒	☒	☒	☒
Haploid nucleus	☒	☒	☒	☒

(b) Gametes contain mitochondria. Describe the function of mitochondria in sperm cells.

(2)

(c) Explain the importance of meiosis in the production of gametes.

(4)

(Total for Question 1 = 10 marks)

2 The photograph below shows the shiny nematolepis plant (*Nematolepis wilsonii*), which became extinct in the wild. This plant was thought to be extinct as a result of bush fires in South East Australia during 2009.

It had been found in only one site in the wild and this site was burnt to a depth of over one metre. This destroyed seeds that were in the soil.

Magnification ×1

(a) (i) State what is meant by the term **species richness**.

(1)

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(ii) Suggest what effect the extinction of the shiny nematolepis plant would have on species richness in South East Australia.

(1)

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(b) Suggest why the shiny nematolepis plant was considered to be an endemic species before the bush fires of 2009.

(1)

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(c) Shiny nematolepis seeds had already been stored at the Millennium Seed Bank at Kew. These seeds were used to restore this plant species and to ensure its survival.

(i) Explain how these seeds were selected for storage in the seed bank.

(3)

(ii) Describe the conditions used for the storage of seeds in seed banks.

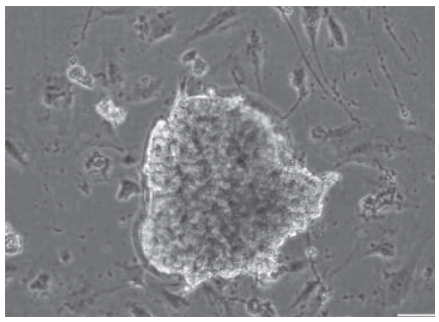
Explain why seeds are stored in these conditions.

(3)

(Total for Question 2 = 9 marks)

3 Scientists have used stem cells collected from a patient's own heart tissue to heal tissue damaged by heart attacks.

The photograph below shows a stem cell extracted from heart tissue.



Magnification ×200

After collection, the stem cells were grown in a laboratory to increase their numbers. These stem cells were then put into the coronary arteries surrounding the heart of the patient.

The stem cells developed into heart muscle cells, which repaired the damaged heart tissue.

(a) (i) Place a cross (☒) in the box that best identifies the name of the property that would enable these stem cells to give rise to heart muscle cells.

(1)

☒ **A** cardiopotency

☒ **B** omnipotency

☒ **C** pluripotency

☒ **D** totipotency

(ii) Explain how these stem cells become specialised and develop into heart muscle cells.

(4)

(b) Explain the advantages of using stem cells from the patient instead of using stem cells from a donor.

(2)

(c) Suggest why this form of stem cell therapy is less controversial than embryonic stem cell therapy.

(2)

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(Total for Question 3 = 9 marks)

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4 Organisms can be classified into three domains: Archaea, Bacteria and Eukaryota. Fungi belong to the domain Eukaryota.

(a) (i) State **two** differences between the structure of cells of organisms belonging to the Eukaryota domain and those belonging to the Bacteria domain.

(2)

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2 .....

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(ii) Name an organelle found in the cells of both eukaryotic and prokaryotic organisms.

(1)

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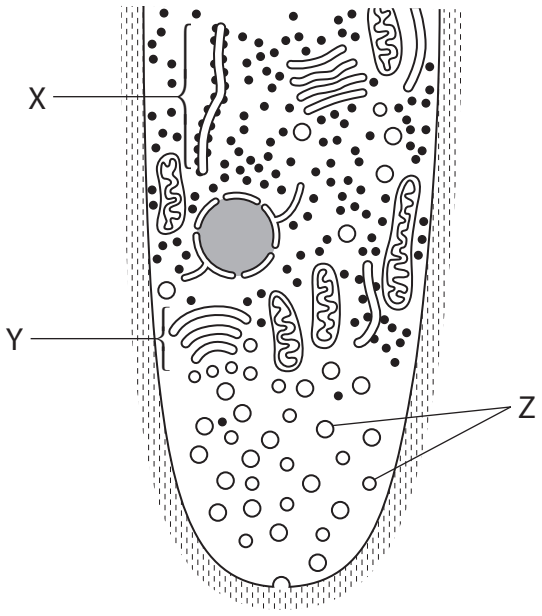
(b) Fungi have structures called hyphae that secrete enzymes used for the extracellular digestion of food.

The diagram below shows a growing tip of one fungal hypha containing vesicles, labelled Z. These vesicles contain digestive enzymes.



(i) Name the organelle labelled X on the diagram.

(1)

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(ii) Place a cross (☒) in the box next to the correct name of the organelle labelled Y on the diagram.

(1)

☒ **A** Golgi apparatus

☒ **B** mitochondrion

☒ **C** rough endoplasmic reticulum

☒ **D** smooth endoplasmic reticulum

*(iii) The organelles labelled X, Y and Z on the diagram are involved in the synthesis and secretion of digestive enzymes.

Describe the roles of these organelles in the synthesis and secretion of digestive enzymes.

(4)

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(c) Fungi produce different enzymes that can digest starch or cellulose.

Using your knowledge of the structure of starch and cellulose, suggest why it is necessary for fungi to produce different enzymes to digest these two substances.

(4)

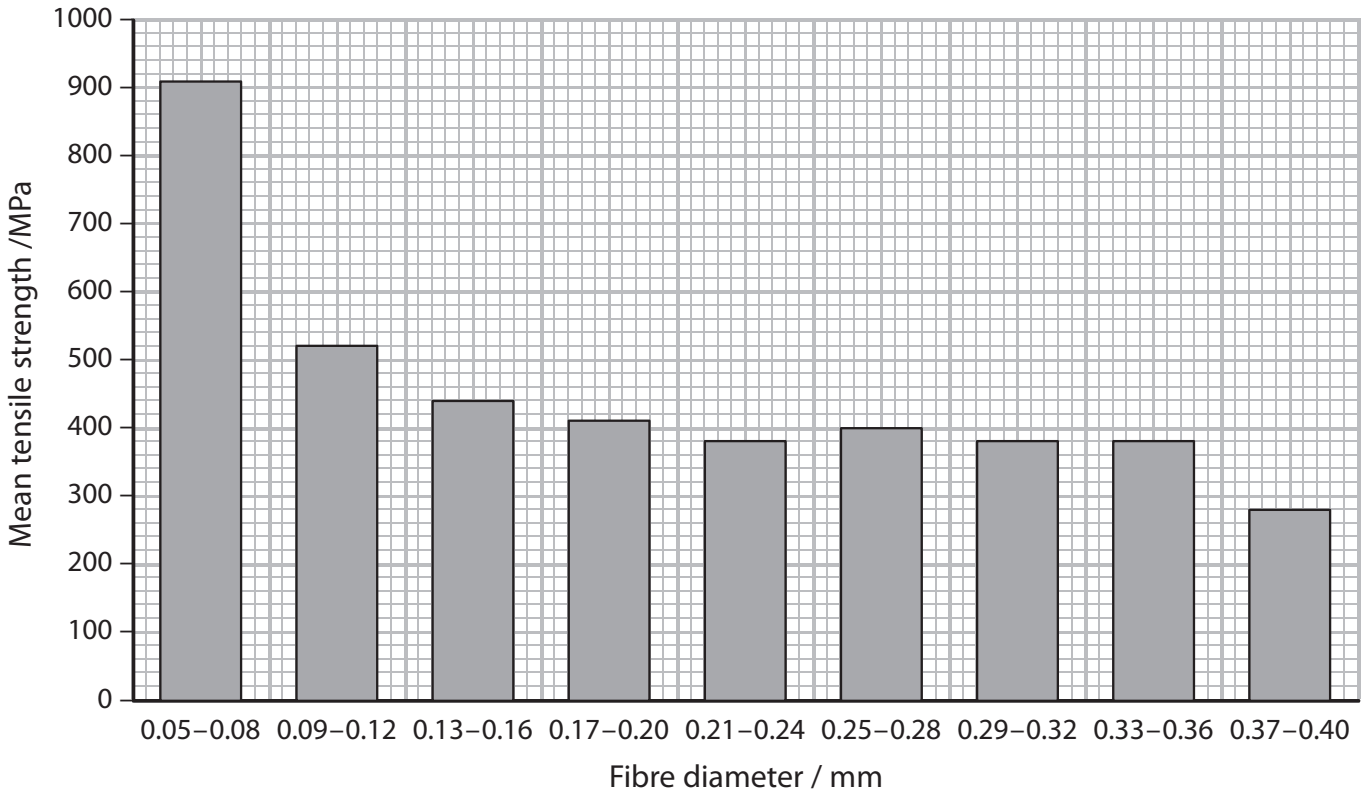
(Total for Question 4 = 13 marks)

5 The photograph below shows a sisal plant. Fibres from its leaves are used to make rope.

Magnification ×0.02

Tensile strength is the force required to break a fibre when it is placed under stress. The units used to measure this force are megapascals (MPa).

The graph below shows the mean tensile strength of sisal fibres of different diameters.



(a) (i) Using information in the graph, describe the relationship between the diameter and the mean tensile strength of the fibres.

(3)

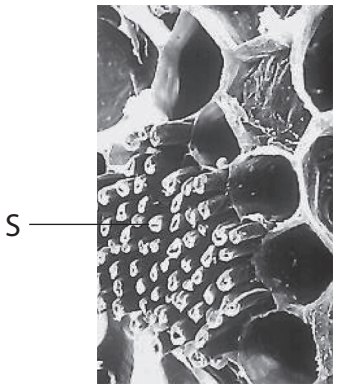
(ii) Suggest which variables should be controlled when investigating the tensile strength of fibres of different diameters.

(3)

(b) Suggest **two** advantages of making rope from a sustainable resource, such as sisal, instead of oil-based plastics.

(2)

(c) The fibres used from sisal are mainly sclerenchyma tissue. The photograph below shows a group of sclerenchyma fibres labelled S.



Magnification ×100

Using information in the photograph and your own knowledge, suggest how the structure of sclerenchyma fibres makes them useful for making rope.

(2)

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(Total for Question 5 = 10 marks)

6 The photograph below shows a waxy leaf frog (*Phyllomedusa sauvagii*). This species of frog is found in hot, dry areas of South America.

It has glands that produce waxy lipids to spread over its skin. This reduces water loss. The waxy leaf frog is active only at night, when it hunts for insects in the trees.

Magnification ×0.5

(a) (i) Describe how the waxy leaf frog is physiologically adapted to its environment.

(1)

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(ii) Describe a behavioural adaptation of the waxy leaf frog to its environment.

(1)

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(iii) Suggest how the behavioural adaptation described enables the waxy leaf frog to survive in this habitat.

(1)

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(b) With reference to the waxy leaf frog, explain what is meant by the term **niche**.

(2)

*(c) Suggest how natural selection could have given rise to the adaptations shown by the waxy leaf frog.

(5)

(Total for Question 6 = 10 marks)

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7 The photograph below shows hydrangea flowers. These flowers are white or coloured.

The allele for producing coloured flowers is dominant. If no pigment is produced, the flowers will be white.

Magnification ×0.25

(a) Suggest the genotype for white hydrangea flowers.

(1)

(b) The different colours are caused by a pigment. The pigment appears blue when the concentration of aluminium ions in the soil is high. The pigment appears pink when the concentration of aluminium ions in the soil is low.

Scientists investigated the effect of soil pH on the colour of hydrangea flowers.

The table below shows their results.

pH of soil	Flower colour
4.5	Deep vivid blue
5.0	Medium blue
5.5	Lavender purple
6.0	Purplish pink
6.5	Mauve pink
6.8	Medium pink
7.0	Deep vivid pink

(i) Name the phenotype being investigated.

(1)

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(ii) Using information from the table, explain the effect pH has on the aluminium ions in the soil.

(3)

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(iii) Explain why changing the pH of the soil would have no effect on the colour of white hydrangeas.

(2)

(c) Flowers of other plants show continuous variation in colour due to polygenic inheritance rather than environmental factors.

Explain what is meant by the term **polygenic inheritance**.

(2)

(Total for Question 7 = 9 marks)

8 The photograph below shows apples on a tree. The mass of apples produced by an apple tree depends on the type of fertiliser used. Fertilisers provide inorganic ions required by plants.

Magnification ×0.5

(a) Plants use inorganic ions. Place a cross (☒) in the box that identifies the correct response.

(i) Plants require the following inorganic ion to make the amino acids required for growth

(1)

☒ **A** calcium

☒ **B** nitrate

☒ **C** phosphate

☒ **D** sulfate

(ii) Plants require magnesium ions as a component of

(1)

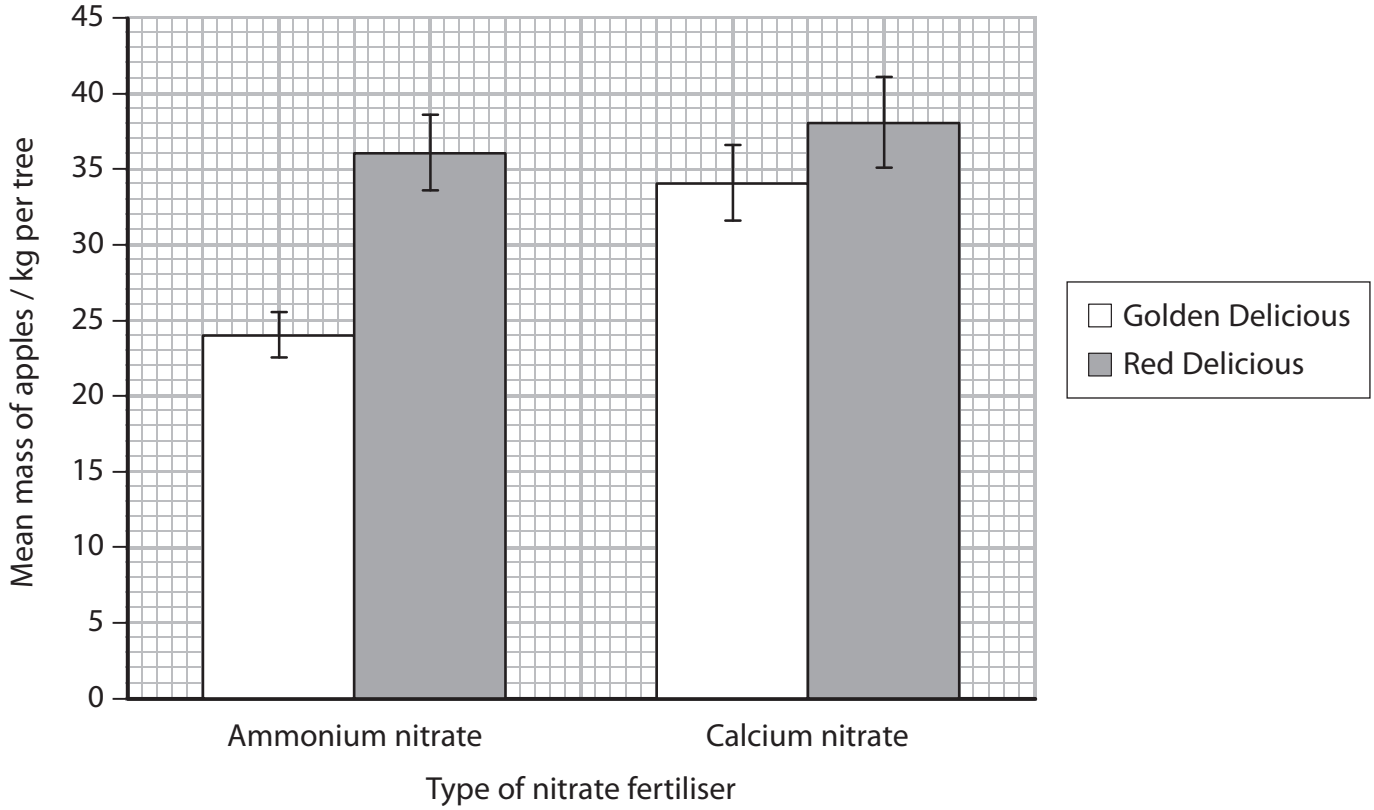
☒ **A** cellulose

☒ **B** chlorophyll

☒ **C** phytochrome

☒ **D** protein

(b) The graph below shows the effect of different nitrate fertilisers on the mean mass of apples produced by Golden Delicious and Red Delicious apple trees.



(i) Using the information in the graph, describe the effects of the fertilisers on the mean mass of Golden Delicious apples produced.

(2)

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(ii) A farmer has decided to plant apple trees.

Suggest how the farmer could use the information given in the graph.

(2)

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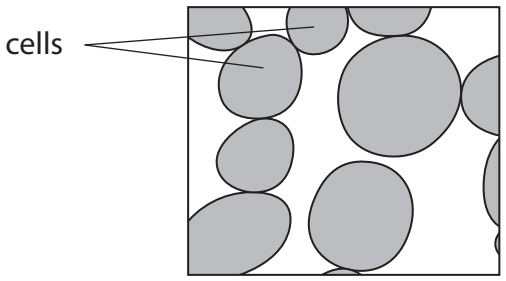
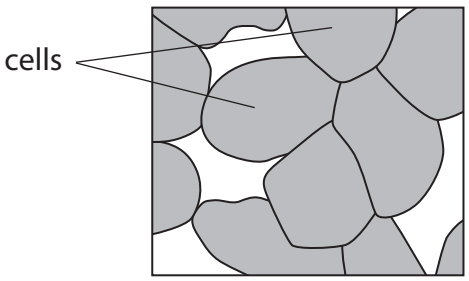
(c) Apples with a high proportion of calcium stay firmer and can be stored for longer.

Scientists examined cells from Golden Delicious apples stored for seven months. They compared the cell structure of apples from trees given ammonium nitrate with those given calcium nitrate.



Cells from apples grown on trees given ammonium nitrate



Cells from apples grown on trees given calcium nitrate

Golden Delicious apples from trees given calcium nitrate were firmer than those from trees given ammonium nitrate.

Using information from the diagrams and your knowledge of the structure of plant cell walls, suggest an explanation for this difference.

(4)

(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 80 MARKS

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