

Write your name here

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Other names

Pearson
Edexcel GCE

Centre Number

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Candidate Number

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Biology

Advanced Subsidiary

Unit 2: Development, Plants and the Environment

Tuesday 7 June 2016 – 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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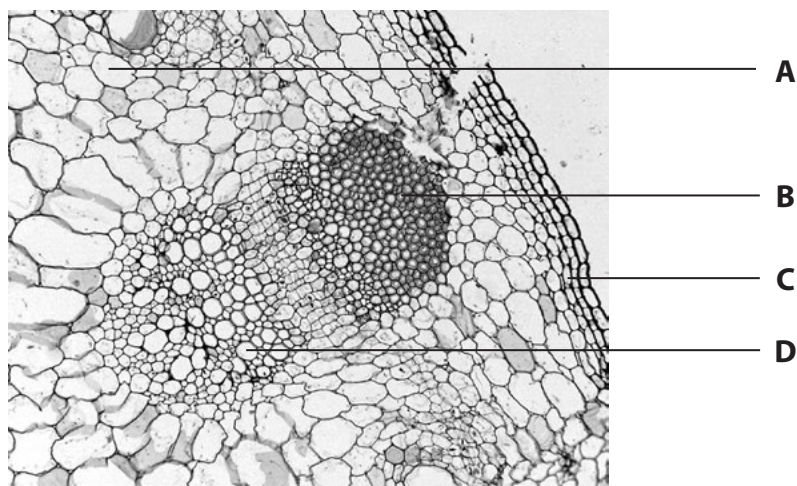


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Answer ALL questions.

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 The photograph below shows a cross-section through part of the stem of a sunflower (*Helianthus annuus*) as seen using a microscope.



Magnification $\times 200$

- (a) Give the letter that correctly identifies the plant tissues shown in the photograph above.

(2)

Sclerenchyma

Xylem

- (b) Statements concerning xylem and sclerenchyma tissue are shown in the table below. Place a cross in the box ☐ to indicate whether each statement is true or false.

(4)

Statement	True	False
Both tissues have a structural function	☐	☐
Both tissues have a transport function	☐	☐
End plates are missing in xylem vessels	☐	☐
Xylem vessels have tapered ends	☐	☐



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*(c) Describe the structure of the cell wall of a xylem vessel.

(4)

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(Total for Question 1 = 10 marks)



- 2 (a) In the space below, draw a sperm cell. On your diagram, label each of the following structures: **nucleus**, **mitochondria**, **flagellum** and **acrosome**.

(4)

- (b) Explain the function of each of the following structures of a sperm cell.

- (i) Flagellum

(1)

- (ii) Mitochondria

(2)

- (iii) Acrosome

(2)

(Total for Question 2 = 9 marks)



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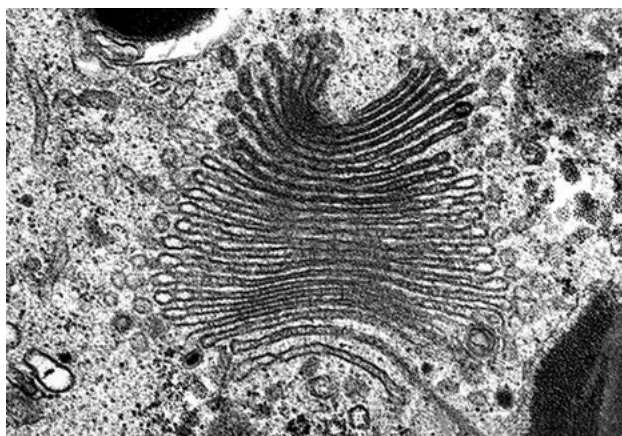
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- 3 The electronmicrograph below shows a Golgi apparatus in part of a cell.



Magnification $\times 10\,000$

- (a) Using information from the electronmicrograph, explain how this organelle can be identified as a Golgi apparatus.

(3)



(b) Describe the role of the Golgi apparatus.

(4)

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(Total for Question 3 = 7 marks)



4 The cell cycle is involved in the production of new cells.

The table below shows the time spent in each stage for a cell with a cell cycle of 24 hours.

Stage of cell cycle	Time / hours
Production of proteins and organelles (G1 phase)	10
S phase	8
Production of proteins and organelles (G2 phase)	4
Mitosis	1
Cytokinesis	1

(a) Describe the **end result** of each of the following stages of this cell cycle.

(i) Mitosis

(2)

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(ii) S phase

(2)

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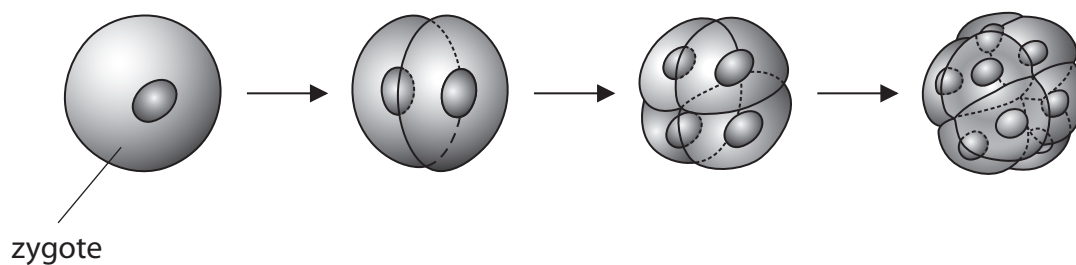
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(b) After fertilisation, a zygote divides rapidly to produce more cells.

The diagram below shows a zygote and the results of the first three cell cycles.



(i) State the number of cells that would be present after **three** more cell cycles.

Place a cross ☒ in the box next to the correct answer.

(1)

- ☐ A 16
- ☐ B 32
- ☐ C 64
- ☐ D 128

(ii) The first few cell cycles may be as short as 30 minutes. They do not have G1 or G2 phases, only alternating S phases and mitosis.

Using information from the table and your own knowledge, suggest why the cells produced become smaller after each cell cycle.

(2)

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(c) Cells stop dividing as they become specialised.

Describe the processes that take place inside a cell during specialisation.

(4)

(d) Specialised cells of an embryo become tissues and organs in the fetus.

Give **two** differences between tissues and organs.

(2)

1

2

(Total for Question 4 = 13 marks)



- 5 The photograph below shows packaging pellets made from thermoplastic starch, which is produced from corn starch. These pellets can be produced from a sustainable resource.



Magnification $\times 0.5$

- (a) (i) Explain what is meant by the term **sustainable**.

(2)

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- (ii) Other packaging pellets contain polystyrene made from crude oil.

Explain why packaging pellets made from thermoplastic starch are sustainable but polystyrene pellets are not sustainable.

(2)

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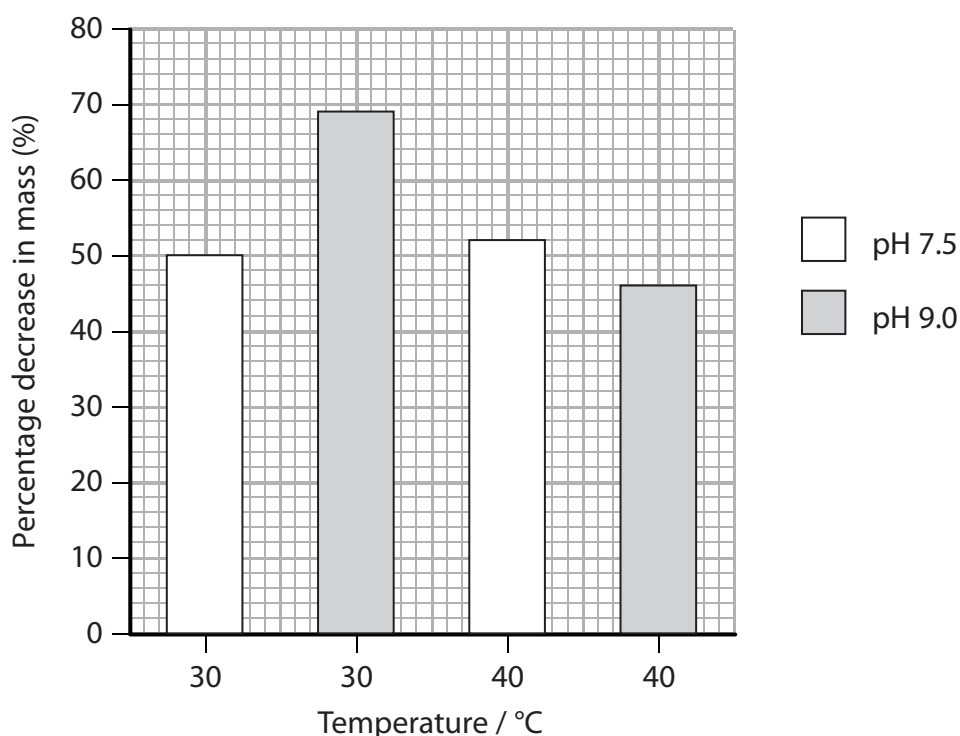
- (b) Scientists investigated various factors that affect the breakdown of a starch-based plastic. They tested plastic sheets made from a starch-based plastic.

Pieces of the plastic sheet were placed in beakers containing a solution of an enzyme that breaks down starch.

In one beaker, the enzyme solution had a pH of 7.5 and in the other it had a pH of 9.0. These beakers were then incubated at 30°C for 10 days. The percentage decrease in mass of the plastic sheet was recorded.

The investigation was then repeated at 40°C.

The results are shown in the graph below.



- (i) Using information from the graph, suggest which conditions were best for the breakdown of the plastic.

(1)



(ii) Using information from the graph, describe the effect of temperature on the breakdown of the plastic.

(3)

(iii) Suggest **two** factors that would have been kept constant to make this a valid investigation.

(2)

1

2

(iv) Suggest why it would not be valid to use these data to predict what would happen at a temperature of 30°C and a pH of 11.0.

(1)

(Total for Question 5 = 11 marks)



- 6 An investigation was carried out into the effects of different plant extracts on 13 species of bacteria. This investigation was carried out in a university laboratory, using species of bacteria that cause disease in humans.

The bacteria were grown on agar in Petri dishes. Plant extracts were added to 0.5 cm² filter paper discs and the discs were placed on the surface of the agar.

The Petri dishes were then incubated at 37 °C for 24 hours.

After incubation, the zones of inhibition were measured. If the zone of inhibition was greater than 7 mm, the bacteria were described as sensitive to the plant extract.

The results are shown in the table below.

Plant extract	Part of the plant used to prepare extract	Number of species of bacteria showing sensitivity
Basil	Leaves and stem	1
Clove	Flower bud	8
Lemon balm	Leaves and stem	3
Rosemary	Leaves and stem	1
Sage	Leaves and stem	0
Thyme	Leaves and stem	3

- (a) (i) Explain what is meant by **zone of inhibition**.

(1)

- (ii) Suggest why the size of the zone of inhibition was used to indicate how sensitive the bacteria were to the plant extracts.

(1)



- (b) Using the information from the table, suggest what conclusions can be drawn from these data.

(3)

- (c) Suggest **one** way in which this investigation could be improved. Give an explanation for your answer.

(2)

- (d) Suggest a change that would have to be made if this investigation were to be carried out **safely** in a school laboratory. Give a reason for your suggestion.

(2)

(Total for Question 6 = 9 marks)



- 7 The pigment melanin affects fur colour in mammals, such as rabbits.

As a result of polygenic inheritance, some breeds of rabbit may have fur that ranges in colour from light brown to black.

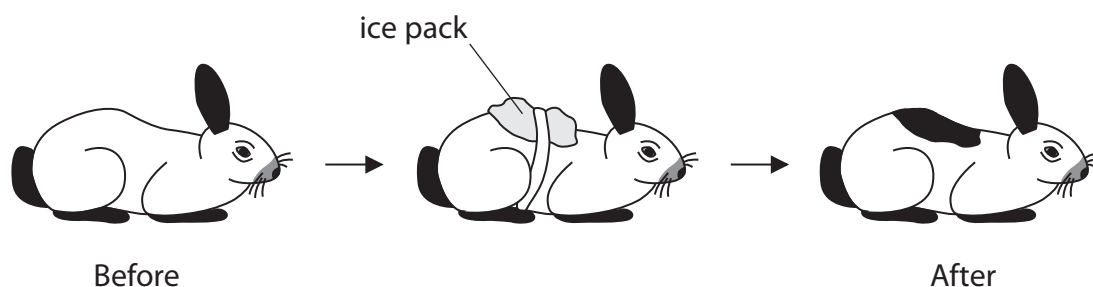
- (a) Explain what is meant by the term **polygenic inheritance**.

(2)

- (b) Himalayan rabbits are white with black fur on their ears, tails and feet.

An experiment was carried out to investigate the effect of temperature on the fur colour in Himalayan rabbits. An area of fur was shaved from the back of a rabbit and an ice pack taped to the area until the fur grew back.

The fur that grew back was black.



- (i) Suggest a control for this experiment.

(1)



- (ii) It is thought that the expression of the gene for fur colour in Himalayan rabbits is affected by the environment.

Explain how this experiment provides evidence to support this hypothesis.

(3)

- (c) The production of melanin is controlled by an enzyme called tyrosinase.

Further investigations suggested that in Himalayan rabbits the enzyme tyrosinase is inactive at temperatures above 25°C.

Suggest how the results of this investigation support this hypothesis.

(2)

(Total for Question 7 = 8 marks)

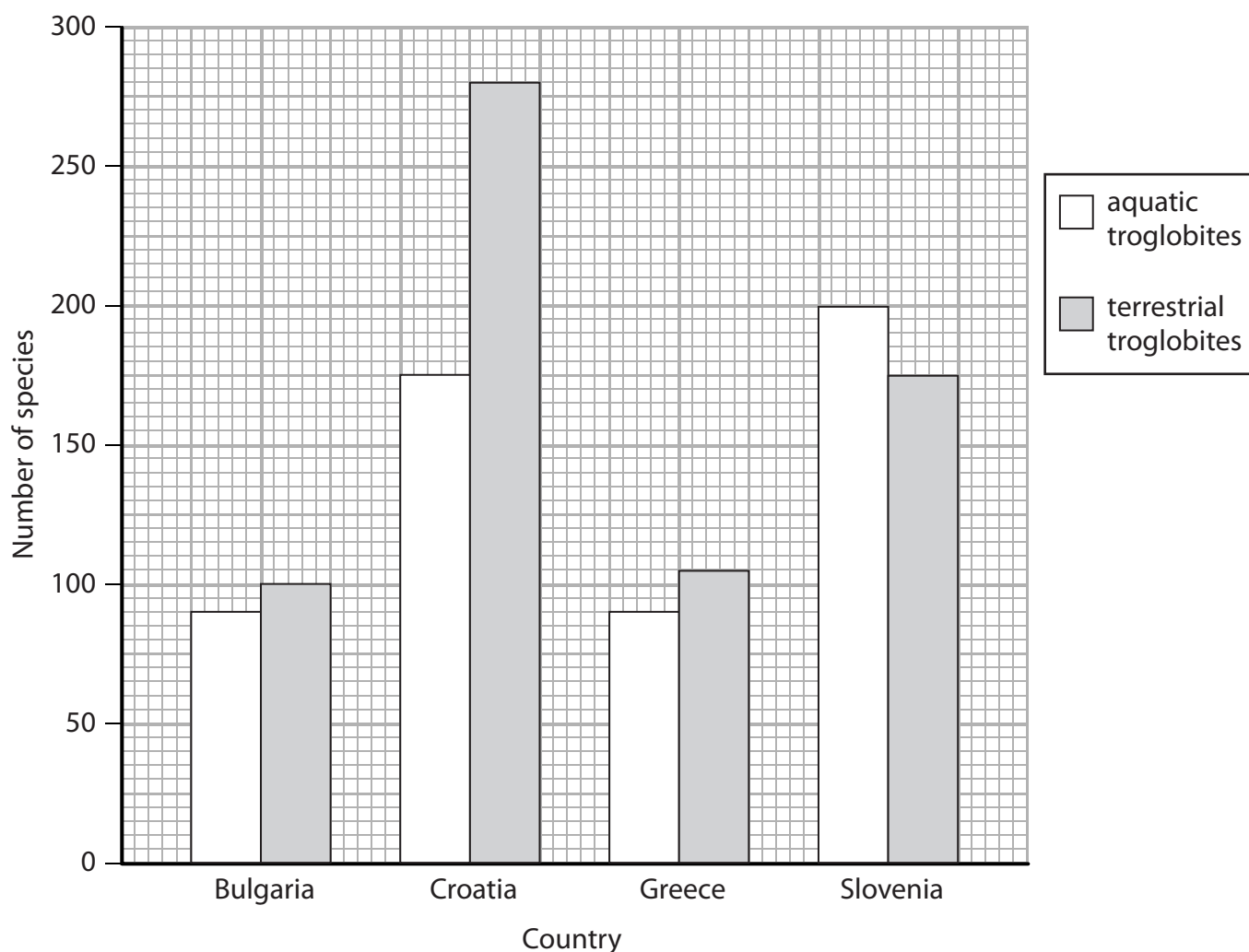


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8 Animals that live only in underground caves are called troglobites.

Aquatic troglobites live in water in caves. Terrestrial troglobites live on the floors and walls of caves.

(a) The graph below shows the numbers of species of aquatic troglobites and terrestrial troglobites in four European countries.



(i) Using information in the graph, identify which country has the lowest biodiversity of troglobites.

(1)

(ii) Place a cross ☒ in the box that corresponds to the correct ratio of aquatic troglobites to terrestrial troglobites in Croatia.

(1)

- ☒ **A** 5:8
- ☒ **B** 6:7
- ☒ **C** 8:7
- ☒ **D** 9:10



(iii) Using the information from the graph, compare the biodiversity of troglobites in Greece and Slovenia.

(2)

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(b) Troglobites occupy different niches.

Explain what is meant by the term **niche**.

(2)

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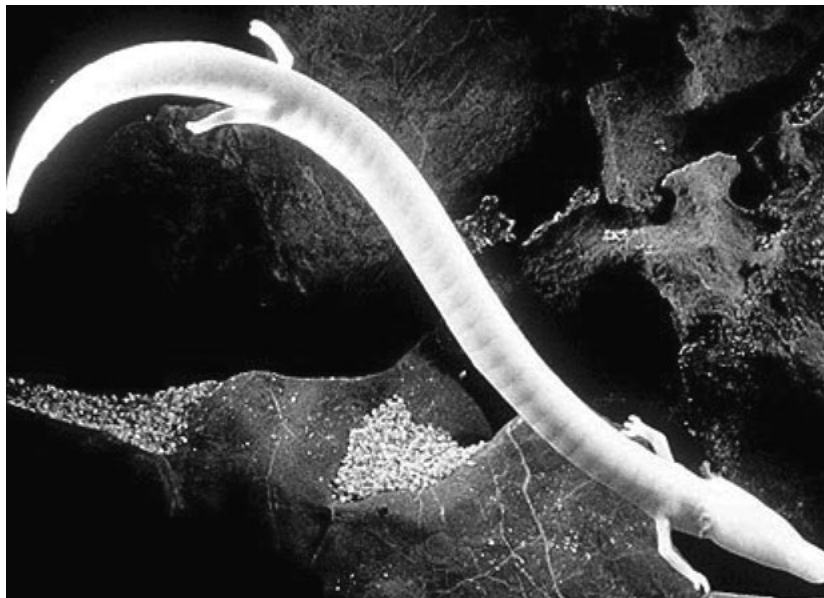
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- (c) An example of a troglobite is the olm, *Proteus anguinus*, as shown in the photograph below. This species is an amphibian endemic to the caves of Slovenia and Croatia.

Olms have a number of special adaptations: external gills as adults, undeveloped eyes, lack of skin pigmentation and a slow metabolic rate.



Magnification $\times 0.1$

- (i) Explain what is meant by the phrase 'endemic to the caves of Slovenia and Croatia'.
(1)

- (ii) Suggest which of the following is a physiological adaptation of olms to their habitat.

Place a cross ☐ in the box corresponding to the correct answer.

(1)

- ☐ **A** external gills as adults
- ☐ **B** slow metabolic rate
- ☐ **C** streamlined shape
- ☐ **D** undeveloped eyes



- * (iii) Olms evolved from small populations of amphibians that lived in caves. These caves became blocked off from other caves by rock barriers.

Suggest how natural selection could have led to the evolution of the olm.

(5)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS



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