Write your name here

| Surname | Other names |
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**Pearson Edexcel Level 3 GCE**

Centre Number | | | | | |

Candidate Number | | | | |

# Biology A (Salters Nuffield)

## Advanced Subsidiary

## Paper 2: Development, Plants and the Environment

Monday 4 June 2018 – Afternoon

**Time: 1 hour 30 minutes**

Paper Reference **8BN0/02**

**You must have:**
Calculator, HB pencil, ruler

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.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You may use a scientific calculator.
- In questions marked with an **asterisk (*)**, marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

### 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.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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P 5 1 7 9 4 A 0 1 2 8

Pearson

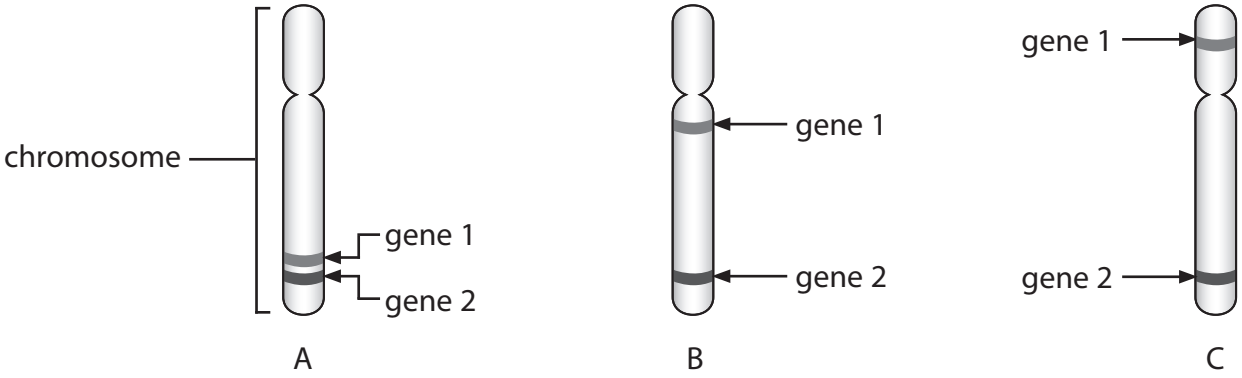
**Answer ALL questions.**

**Write your answers in the spaces provided.**

**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** Linked genes are usually inherited together.

(a) The diagram shows the position of two genes on three chromosomes, A, B and C.




(i) Name the part of a chromosome that is occupied by a gene.

**(1)**

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(ii) Explain which chromosome shows the weakest linkage between genes 1 and 2.

**(3)**

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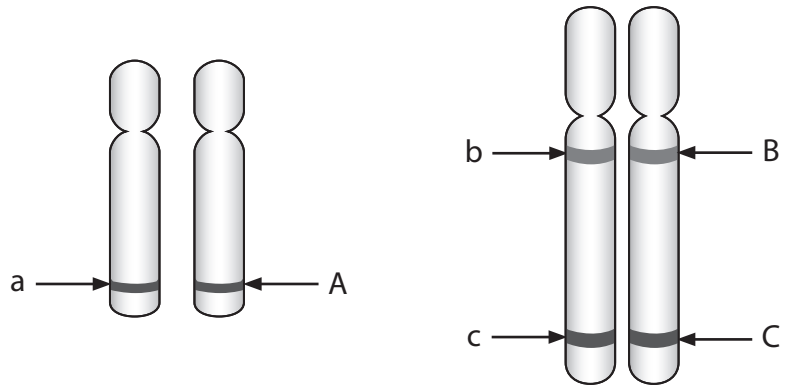
(b) The process of meiosis gives rise to genetic variation. Genes A, B and C are located on two different pairs of chromosomes, as shown in the diagram.




Which combination of alleles could only be present if crossing over has occurred?

**(1)**

☒ **A** ABC

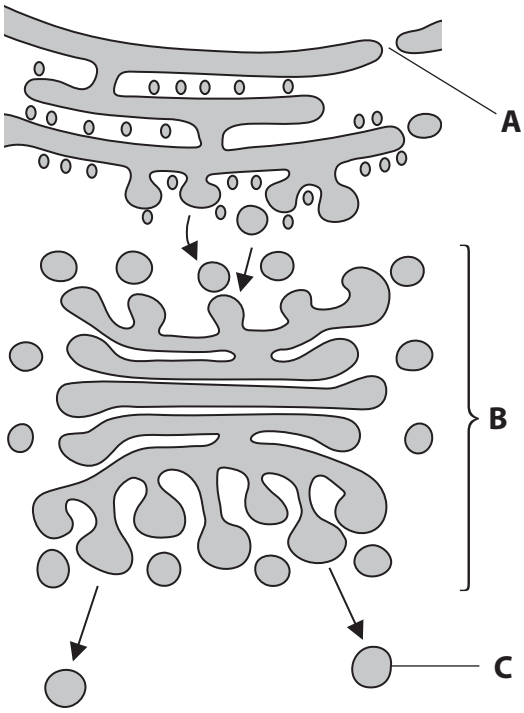
☒ **B** aBC

☒ **C** ABc

☒ **D** Abc

**(Total for Question 1 = 5 marks)**

**2** The diagram shows some of the cell organelles involved in the formation of extracellular enzymes.




(a) Name the parts of the cell labelled **A**, **B** and **C**.

**(3)**

**A** .....

**B** .....

**C** .....

(b) Describe the roles of parts **B** and **C** in the formation and transport of extracellular enzymes.

**(4)**

(c) Extracellular enzymes are produced by specialised cells.

Explain how groups of cells can produce the same enzyme.

**(3)**

(d) Eukaryotic and prokaryotic cells both produce enzymes.

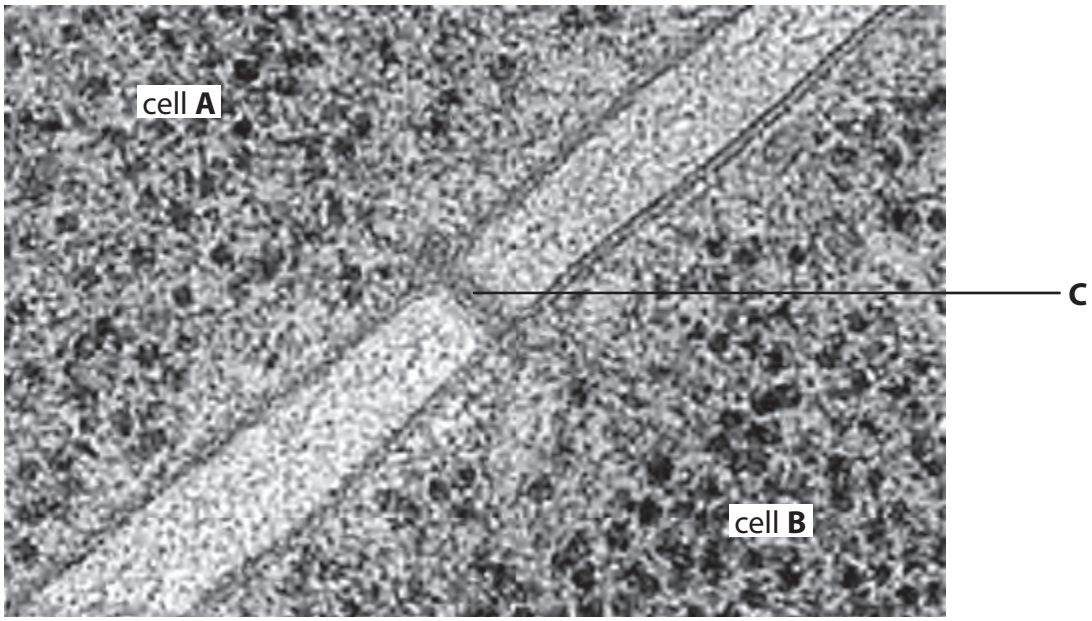
Which of the following pairs of statements is true for eukaryotic and prokaryotic cells?

**(1)**

| | Similarity | Difference |
|---|---|---|
| ☒ **A** | Both possess ribosomes | Only eukaryotic cells possess plasmids |
| ☒ **B** | Both possess pili | Prokaryotic cells do not secrete enzymes |
| ☒ **C** | Both possess ribosomes | Prokaryotic cells do not possess endoplasmic reticulum |
| ☒ **D** | Both possess pili | Only eukaryotic cells possess ribosomes |

**(Total for Question 2 = 11 marks)**

**3** The electronmicrograph shows the junction between two plant cells, **A** and **B**.



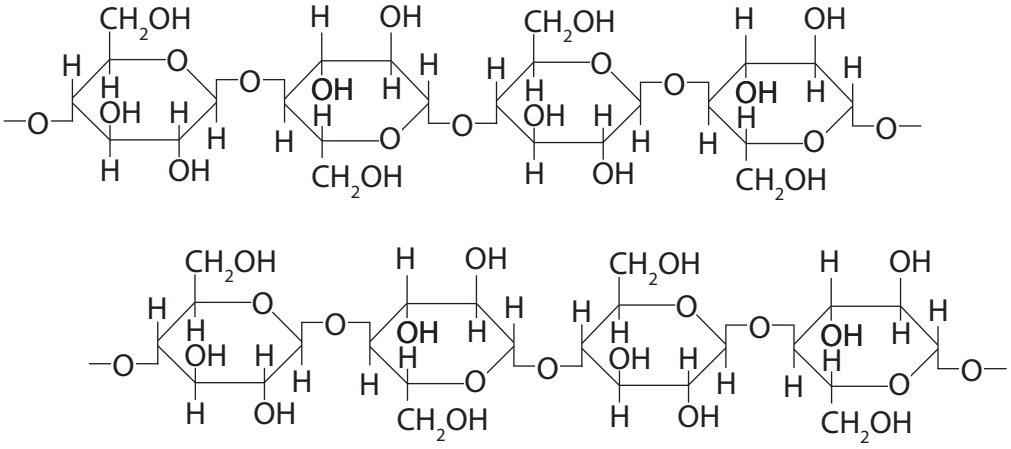

(a) (i) Name the structure labelled **C**.

**(1)**

(ii) Explain the function of the structure labelled **C**.

**(2)**

(b) The cell wall consists of cellulose molecules arranged as microfibrils.
The diagram shows the partial structure of two molecules of cellulose.



(i) Draw **one** link on the diagram that would hold these molecules together in a microfibril.

**(1)**

(ii) Compare and contrast the structure of cellulose and amylopectin.

**(3)**

(c) Plant cells also contain structures called amyloplasts.

Amyloplasts

**(1)**

☒ **A** allow fluid exchange

☒ **B** consist mainly of pectin

☒ **C** are membranes surrounding the vacuole

☒ **D** store starch granules

**(Total for Question 3 = 8 marks)**

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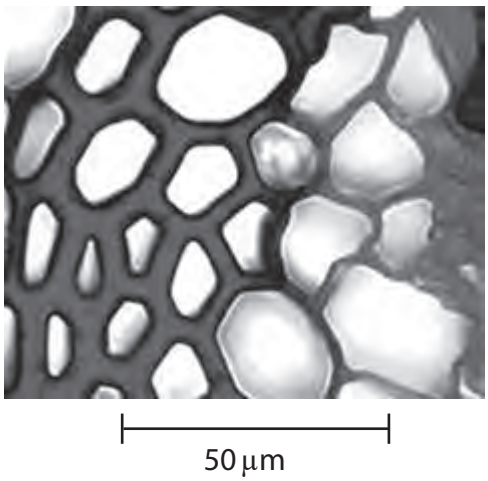
**4** The image shows a cross section of part of a plant stem examined using a light microscope.




(a) (i) Label a sclerenchyma fibre with the letter **S**.

**(1)**

(ii) Calculate the magnification of this image.

**(3)**

Answer .....

(b) (i) A nucleus will be found in a

**(1)**

- ☒ **A** companion cell
- ☒ **B** sclerenchyma fibre
- ☒ **C** sieve tube
- ☒ **D** xylem vessel

(ii) Xylem and sclerenchyma fibres both

**(1)**

- ☒ **A** provide support
- ☒ **B** transport glucose
- ☒ **C** transport hormones
- ☒ **D** transport mineral ions

(iii) The cell wall forms a greater percentage of the total mass of the sclerenchyma fibre than of a phloem sieve tube.

Which of the following explains this difference?

**(1)**

- ☒ **A** phloem sieve tubes do not contain organelles
- ☒ **B** phloem sieve tubes have thinner, lignified walls
- ☒ **C** sclerenchyma fibres contain organelles
- ☒ **D** sclerenchyma fibres have thickened, lignified cell walls

**(Total for Question 4 = 7 marks)**

**5** Mineral ions in the soil affect the growth of the peanut plant, *Arachis hypogaea*.

The effect of mineral ions on the production of fruit by these plants was investigated.

Young peanut plants were grown in soil containing all the mineral ions required.

After one week, 10 of these plants were moved into soil without calcium ions.
Another 10 plants were moved into soil without magnesium ions.

Ten plants were left in the original soil.

After leaving the plants to grow, the mean number of flowers per plant and the percentage of these flowers that formed fruit were recorded.

The results are shown in the table.

| Soil | Mean number of flowers per plant | Percentage of flowers producing fruit (%) |
|---|---|---|
| Containing all minerals | 644 | 9.2 |
| Without calcium ions | 392 | 5.4 |
| Without magnesium ions | 583 | 2.3 |

(a) (i) Calculate the mean reduction in the number of fruit produced by peanut plants grown in soil without calcium ions.

Give your answer to two decimal places.

**(3)**

Answer.....

(ii) Comment on the results of this investigation.

**(3)**

(b) Devise an investigation to determine the effect of nitrate ion concentration on the growth of young peanut plants.

**(5)**

**(Total for Question 5 = 11 marks)**

**6** The saiga antelope is found in the grasslands of Eurasia. In the 1970s its population was 1 250 000. The population has decreased due to loss of habitat and a disease outbreak in 2015.

Population estimates suggest as few as 50 000 individuals remain.

Conservation efforts aim to ensure that the population recovers to previous levels.

(a) The population may recover quickly as saiga antelopes usually produce twins.

(i) Even though both offspring are from the same father and the same mother, they may be genetically different.

Explain why the offspring may be genetically different.

**(2)**

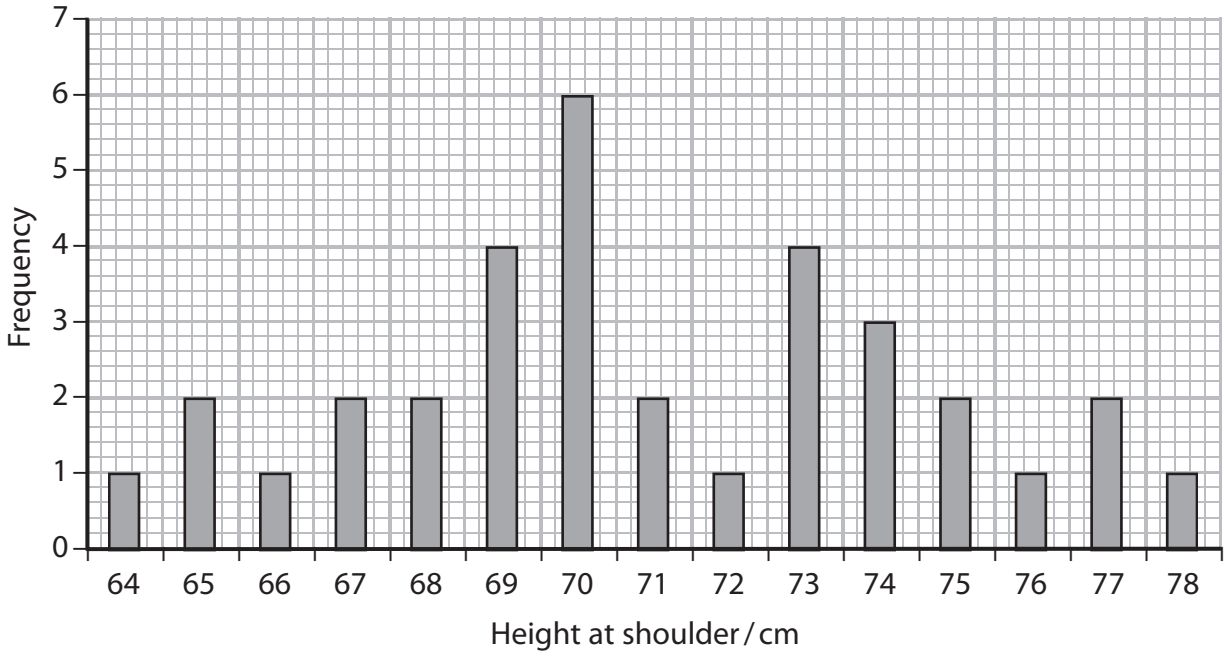
(ii) During fertilisation, only one sperm cell can fertilise an egg cell.

Explain why a second sperm cell cannot fertilise the egg cell.

**(3)**

(b) Endangered animals are monitored to determine the diversity and viability of the population.

The height of 34 saiga antelopes is shown in the graph.




(i) State how the graph provides evidence that this characteristic shows polygenic inheritance.

**(1)**

.....

.....

.....

(ii) Height in animals is determined by polygenic inheritance.

Which is a description of polygenic inheritance of height?

**(1)**

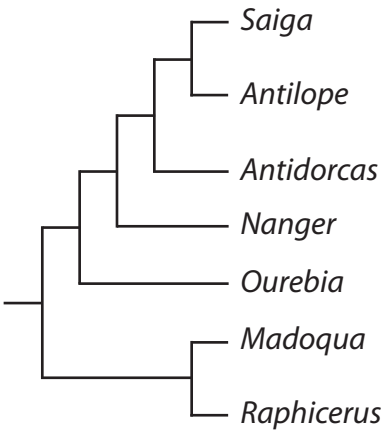
- ☒ **A** controlled by a large number of alleles of one gene
- ☒ **B** controlled by more than one gene
- ☒ **C** controlled by one gene from each parent
- ☒ **D** controlled by one gene and the environment

(iii) State and justify the mode for height of the saiga antelope.

**(2)**

(c) Saiga antelopes are related to a wide range of other species of antelope.

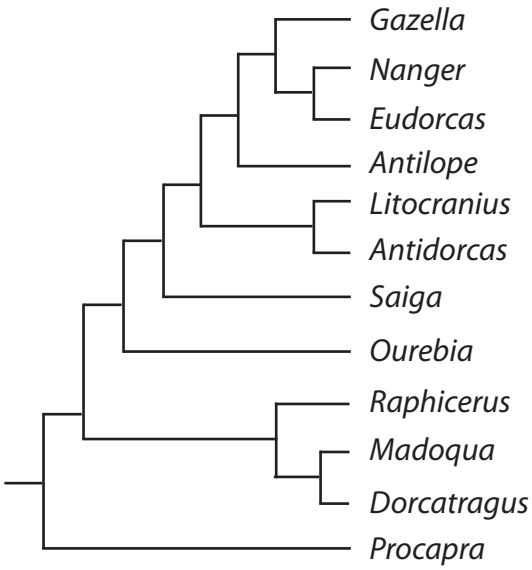
The diagram shows the phylogenetic relationships between some antelopes.
This diagram was produced using data from analysis of a protein.




(i) Explain how this diagram indicates that saiga antelopes are more closely related to *Antilope* than to *Antidorcas*.

**(2)**

(ii) This is a more recent classification diagram based on a study of the mitochondrial genomes of antelopes.




Deduce how this study led to different opinions about the relationship between *Saiga* and *Antilope*.

**(3)**

**(Total for Question 6 = 14 marks)**

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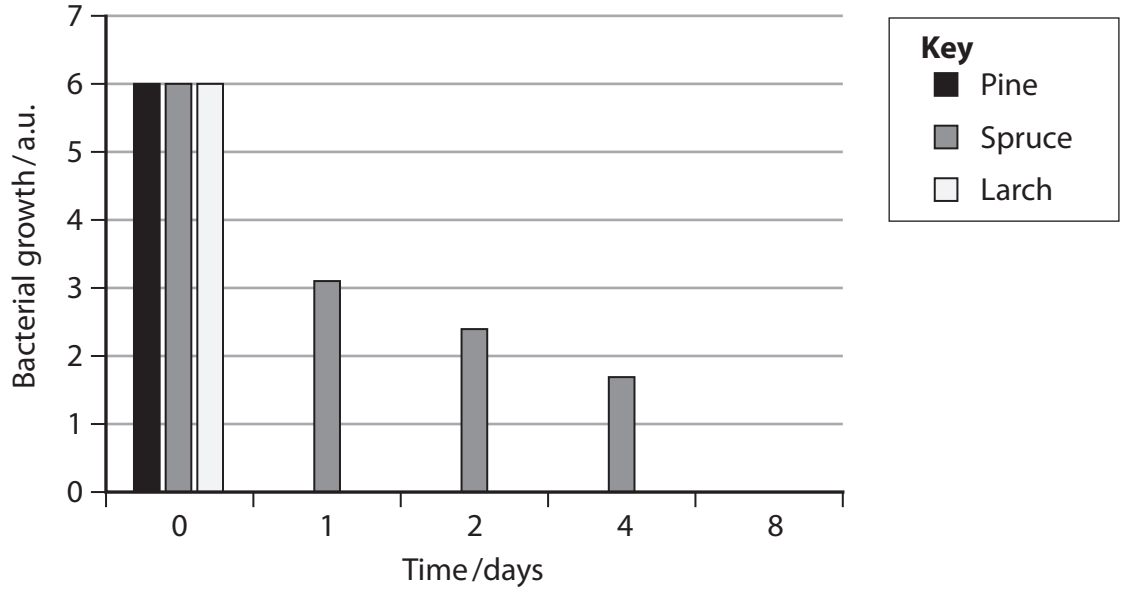
**7** Many plants produce chemicals that have antimicrobial properties.

The suitability of using wood from three types of tree to make kitchen chopping boards was investigated.

In this investigation, 50 $cm^3$ of a bacterial culture was added to 100 g of wood chippings from each of three types of tree.

The growth of bacteria was measured at the start (Day 0), and then after 1, 2, 4 and 8 days.

The results are shown in the graph.




(a) (i) Describe the antimicrobial properties of these three types of wood.

**(2)**

(ii) It was concluded from this investigation that spruce caused bacterial growth to decrease at a constant rate after the first day.

Criticise this conclusion.

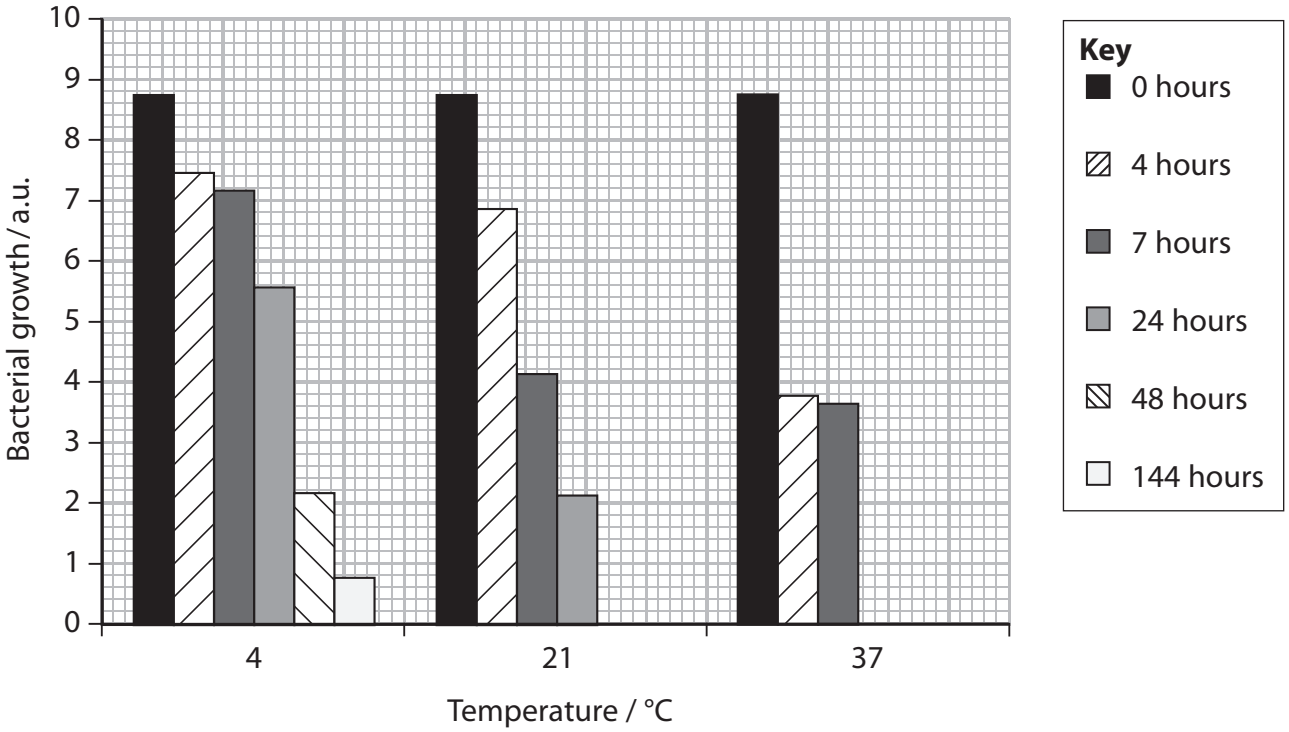
**(2)**

(iii) Explain how this investigation could be improved to provide additional data to determine whether pine or larch have greater antimicrobial properties.

**(4)**

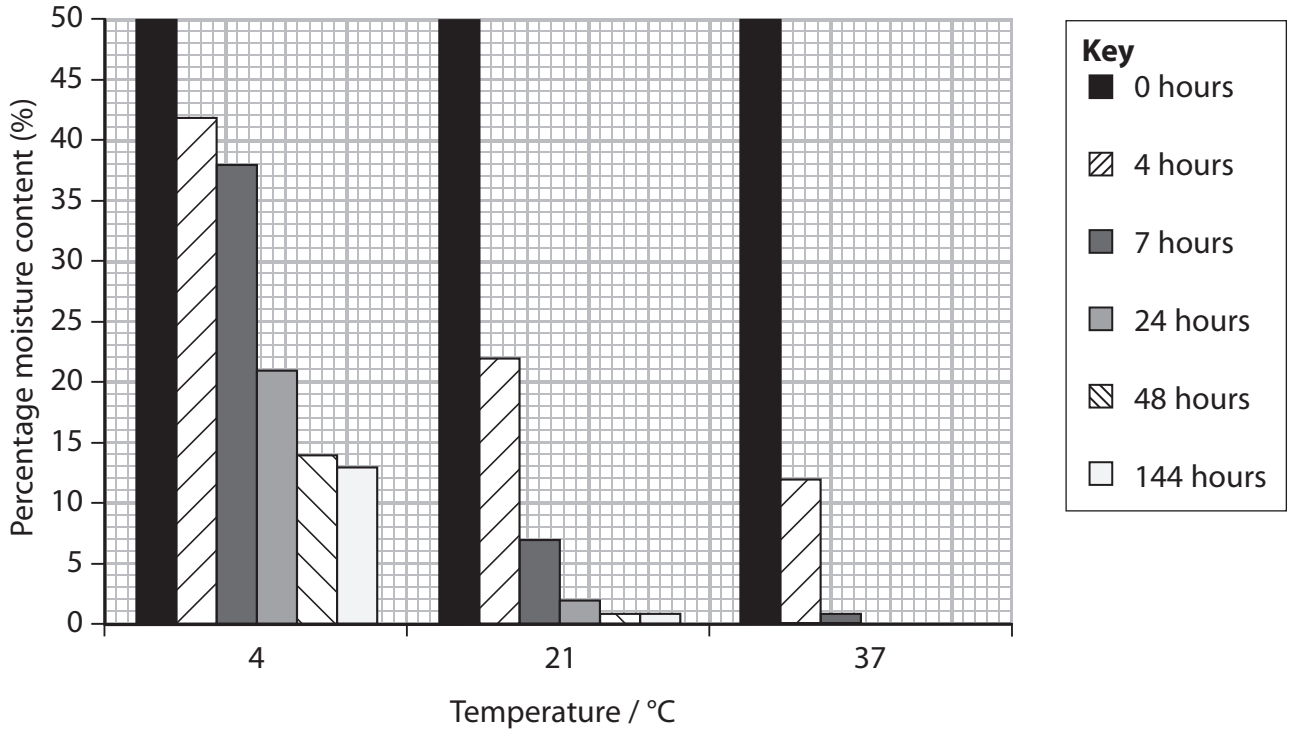
(b) Temperature and the moisture content of wood from pine trees can affect bacterial growth.

Graph 1 shows the effect of temperature on bacterial growth.




**Graph 1**

Graph 2 shows the effect of temperature on the moisture content of wood.




**Graph 2**

Analyse the data to deduce the effects of these two factors on bacterial growth on wood from pine trees.

**(4)**

**(Total for Question 7 = 12 marks)**

**8** Sloths are mammals found in Central and South America.

(a) Sloths are slow moving and use their hooked claws to hold onto branches. They sleep for over 15 hours a day. During this time, their slow metabolism processes their diet of low nutrition vegetation.

Sloths have behavioural, physiological and anatomical adaptations to their environment.

Complete the table using the information provided.

**(3)**

| Type of adaptation | Example |
|---|---|
| Behavioural | |
| Physiological | |
| Anatomical | |

(b) Three species of sloth are described in the table.

| Species | Common name | Status |
|---|---|---|
| *Bradypus pygmaeus* | pygmy three-toed sloth | critically endangered |
| *Choloepus didactylus* | Linné's two-toed sloth | least concern |
| *Choloepus hoffmanni* | Hoffmann's two-toed sloth | least concern |

It is believed that *C. hoffmanni* and *C. didactylus* shared a common ancestor before becoming isolated on either side of the Andes mountain range.

(i) Explain why they are now classed as different species.

**(2)**

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(ii) Which of the following describes the term **niche** with reference to *C. hoffmanni*?

**(1)**

☒ **A** the area where *C. hoffmanni* is found

☒ **B** the preferred diet of *C. hoffmanni*

☒ **C** the risk of *C. hoffmanni* becoming extinct

☒ **D** the role of *C. hoffmanni* in its environment

*(c) The map shows the distribution of two species of sloth.
There are currently two major populations of *C. hoffmanni* in South America.
*B. pygmaeus* is restricted to an island off the coast of Central America.
Each population occupies different habitats.


Discuss why the number of sloth species may change in the future.

**(6)**

**(Total for Question 8 = 12 marks)**

**TOTAL FOR PAPER = 80 MARKS**

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