GradeMax

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Wednesday 14 January 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WBI12/01**

Biology

International Advanced Subsidiary / Advanced Level
UNIT 2: Cells, Development, Biodiversity and Conservation

You must have:
Scientific calculator, ruler, HB pencil

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.*
- **Show all your working out** in calculations and **include units** 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.*
- In the questions labelled 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.

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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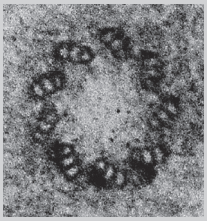
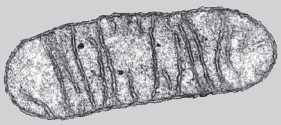
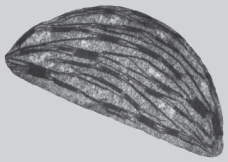
Pearson

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 Animal and plant cells contain organelles.

The table shows three organelles.

Statement	Organelle		
			
absorbs light energy			
contains a double membrane			
contains ribosomes			
forms spindle fibres			

(Source: © ALVIN TELSER / SCIENCE PHOTO LIBRARY)
(Source: © CNRI / SCIENCE PHOTO LIBRARY)
(Source: © DR. .JEREMY BURGESS / SCIENCE PHOTO LIBRARY)

(a) Complete the table by placing ticks (✓) in the appropriate boxes to show which statements are correct for each organelle.

(4)

(b) Which is the **domain** that contains organisms with these organelles in their cells?

(1)

☒ **A** Archaea

☒ **B** Bacteria

☒ **C** Eukarya

☒ **D** Prokarya

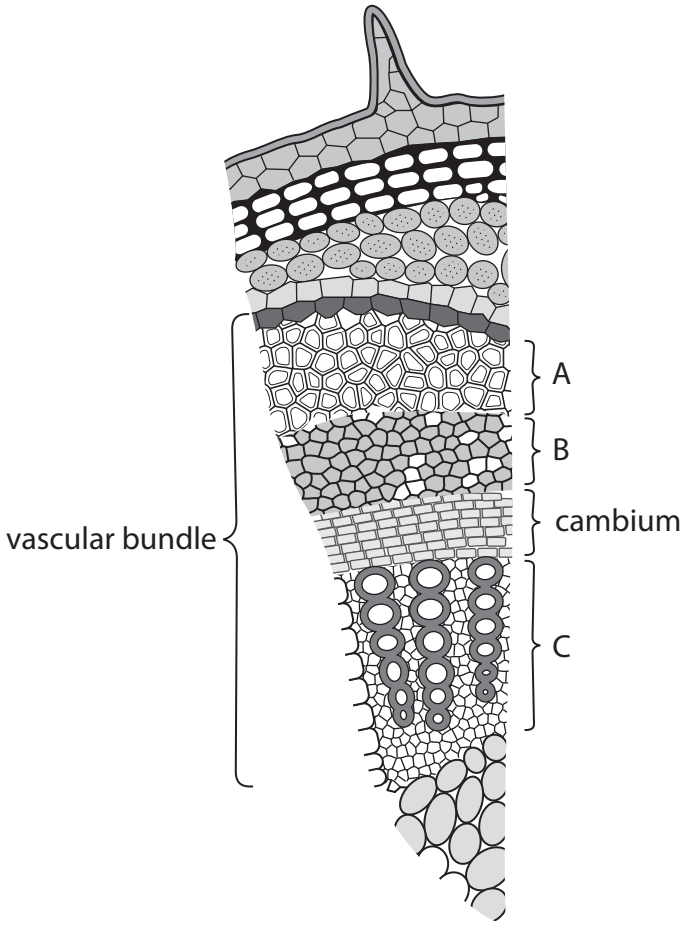
(Total for Question 1 = 5 marks)

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2 Plant stems contain several types of tissue.

The diagram shows part of a plant stem.



(a) The letters A, B and C indicate the locations of three tissues.

Complete the table to show the location of each of these tissues.

(2)

Tissue	Location letter
Phloem	
Sclerenchyma	
Xylem	

(b) Describe the functions of phloem, sclerenchyma and xylem tissues.

(3)

phloem

sclerenchyma

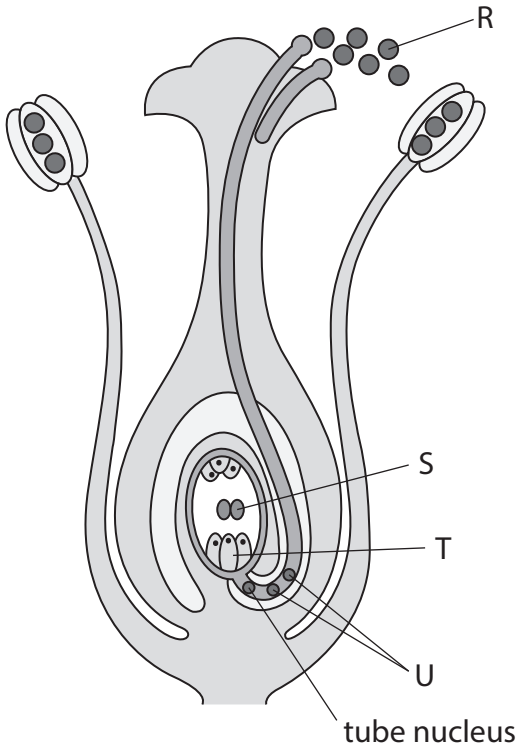
xylem

(Total for Question 2 = 5 marks)

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3 The diagram shows part of a flower from a plant.



(a) (i) Which row in the table gives the names of the structures labelled R, S and T?

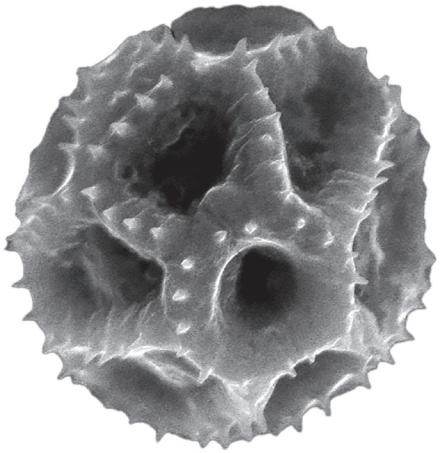
(1)

		R	S	T
☒	**A**	ovule	egg cell	polar nucleus
☒	**B**	ovule	polar nucleus	egg cell
☒	**C**	pollen grain	egg cell	polar nucleus
☒	**D**	pollen grain	polar nucleus	egg cell

(ii) Describe the function of each of the structures labelled U.

(2)

(b) The photograph shows a pollen grain, as seen using a microscope.



scale

5 μm

(Source: © Connect Images / Alamy Stock Photo)

(i) Calculate the magnification of this photograph.

(2)

×.....

(ii) Name the type of microscope used to take this photograph.

Give a reason for your answer.

(2)

Type of microscope

.....

Reason

.....

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(iii) Pollen grains produced by the **same** plant are genetically different from each other.

Explain how genetically different pollen grains are produced by the same plant.

(2)

(Total for Question 3 = 9 marks)

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4 Cellulose and starch are found in plants.

(a) (i) Name the group of organic molecules that includes cellulose and starch.

(1)

.....

(ii) Which structure in a plant cell would contain cellulose?

(1)

☒ **A** amyloplast

☒ **B** cell membrane

☒ **C** cell wall

☒ **D** tonoplast

(iii) Which row in the table shows the bonds found in a cellulose **microfibril**?

(1)

	1,4-glycosidic bond	1,6-glycosidic bond	hydrogen bond
☒ **A**	✓	✓	✗
☒ **B**	✓	✗	✓
☒ **C**	✗	✓	✓
☒ **D**	✗	✗	✗

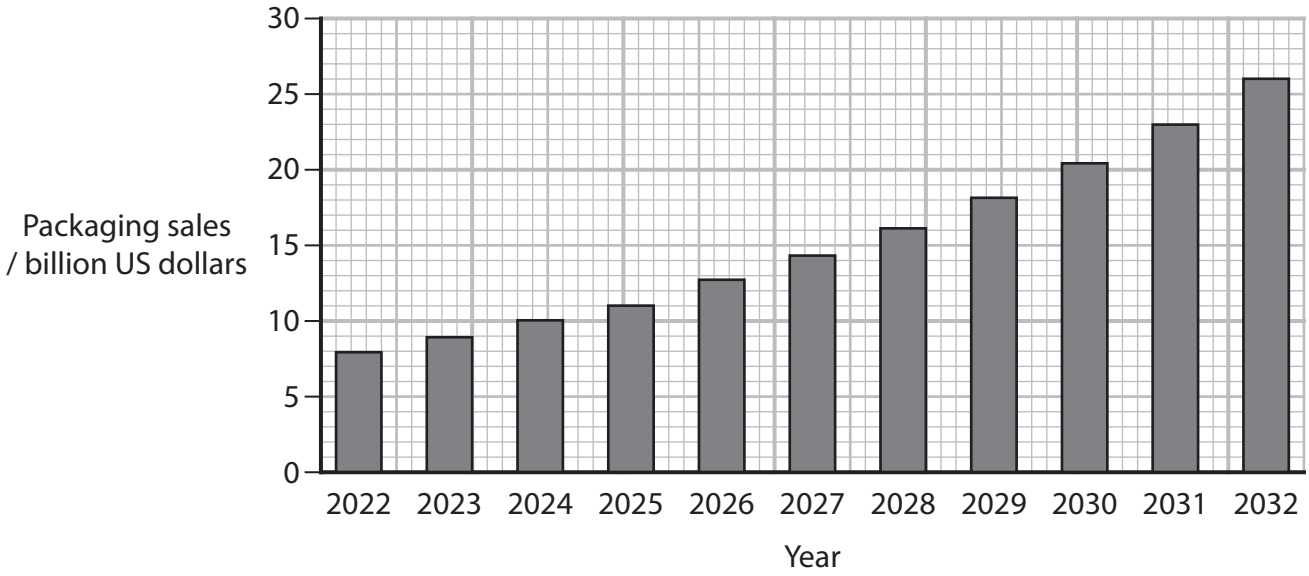
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(b) Starch and cellulose can be used to make plant-based packaging.

Plant-based packaging can contribute to sustainability.

The graph shows the historical, current and expected growth in sales of plant-based packaging.



(i) Give **one** reason why plant-based packaging can contribute to sustainability.

(1)

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(ii) Calculate the expected growth in sales of plant-based packaging from 2025 to 2032 as a percentage.

Give your answer to **two** significant figures.

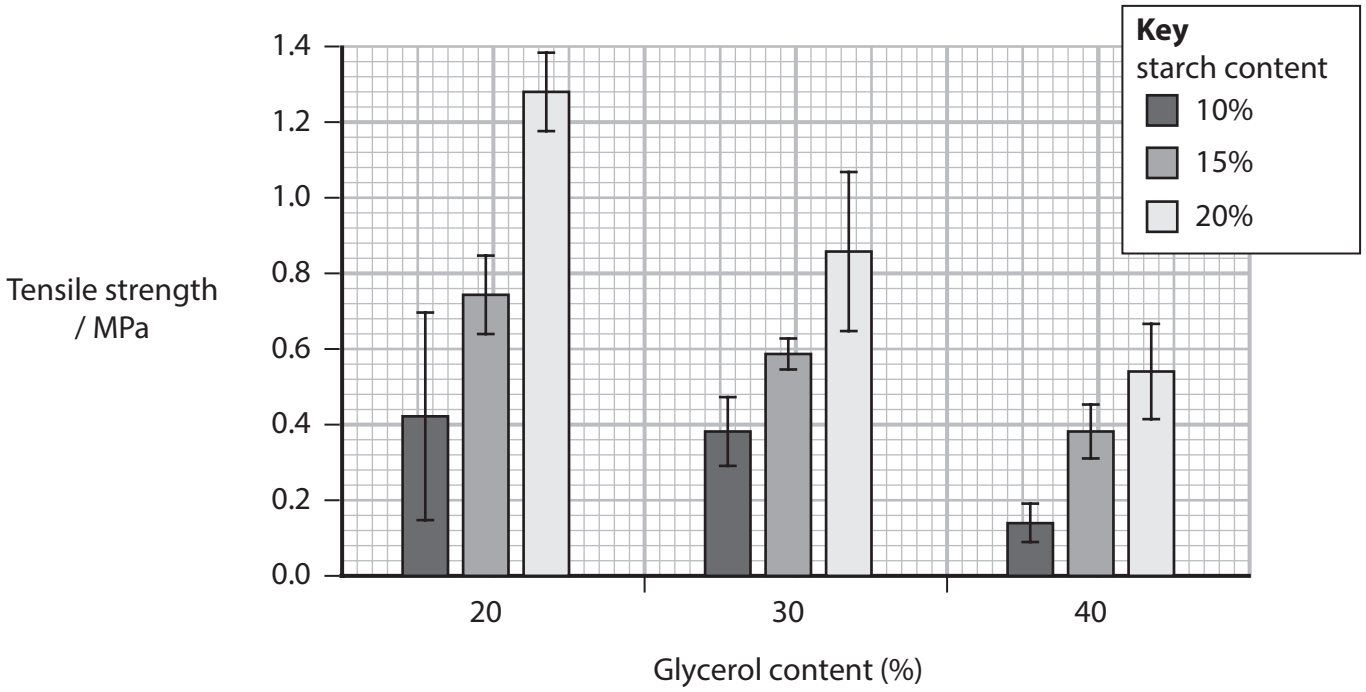
(2)

.....%

(c) Bioplastics contain different percentages of starch and glycerol.

The effect of starch and glycerol on the tensile strength of bioplastic was investigated.

The graph shows the results of this investigation.



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Comment on the effects of starch and glycerol content on the tensile strength of bioplastics in this investigation.

(4)

(Total for Question 4 = 10 marks)

5 Gametes are specialised for their functions.

(a) The table shows some information about gametes.

Which row in the table is correct?

(1)

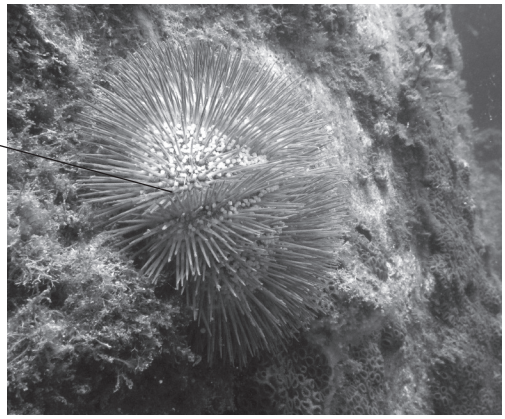
		Cortical granules are found in	Mitochondria are found in
☒	**A**	egg cells only	egg cells and sperm cells
☒	**B**	egg cells only	egg cells only
☒	**C**	egg cells and sperm cells	egg cells and sperm cells
☒	**D**	egg cells and sperm cells	egg cells only

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(b) Scientists have shown that the cortical reaction in the egg cells of sea urchins is the same as the reaction in humans.

The photograph shows a sea urchin.



(Source: © Octavio Campos Salles / Alamy Stock Photo)

Polyspermy is when more than one sperm cell enters an egg cell.

When a sperm cell enters a sea urchin egg cell, two processes occur to prevent polyspermy.

One process is the fusion of cortical granules with the cell membrane.

(i) Describe what happens when the cortical granules fuse with the cell membrane.

(2)

(ii) The second process is a change in the membrane potential of the egg cell.

The effect of membrane potential on the mean number of egg cells with polyspermy was investigated.

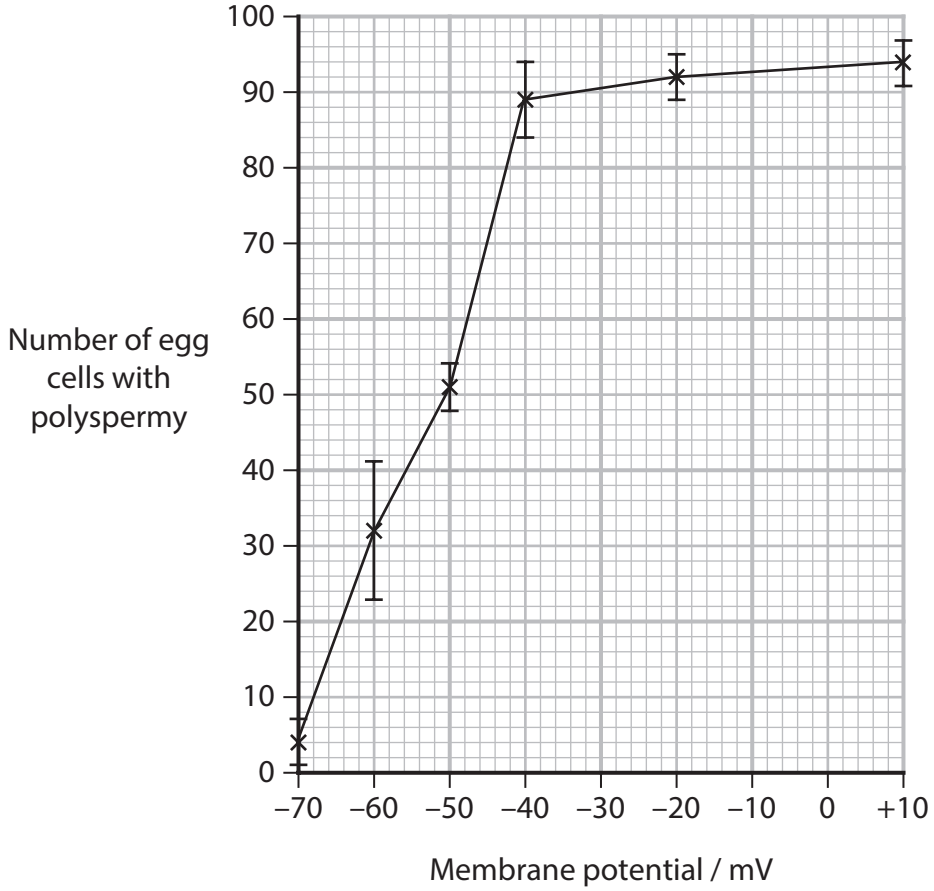
Samples of sperm cells were added to groups of egg cells.

Each group of 100 egg cells had a different membrane potential.

The number of egg cells with polyspermy was determined after 10 minutes.

The investigation was repeated and the mean number of egg cells with polyspermy was calculated.

The graph shows the results of this investigation.



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Comment on the results of this investigation.

Use the data in the graph to support your answer.

(4)

(c) In humans a fertilised egg cell develops into a morula and then into a blastocyst.

Describe the role of the morula and the blastocyst in the development of an embryo.

(3)

(Total for Question 5 = 10 marks)

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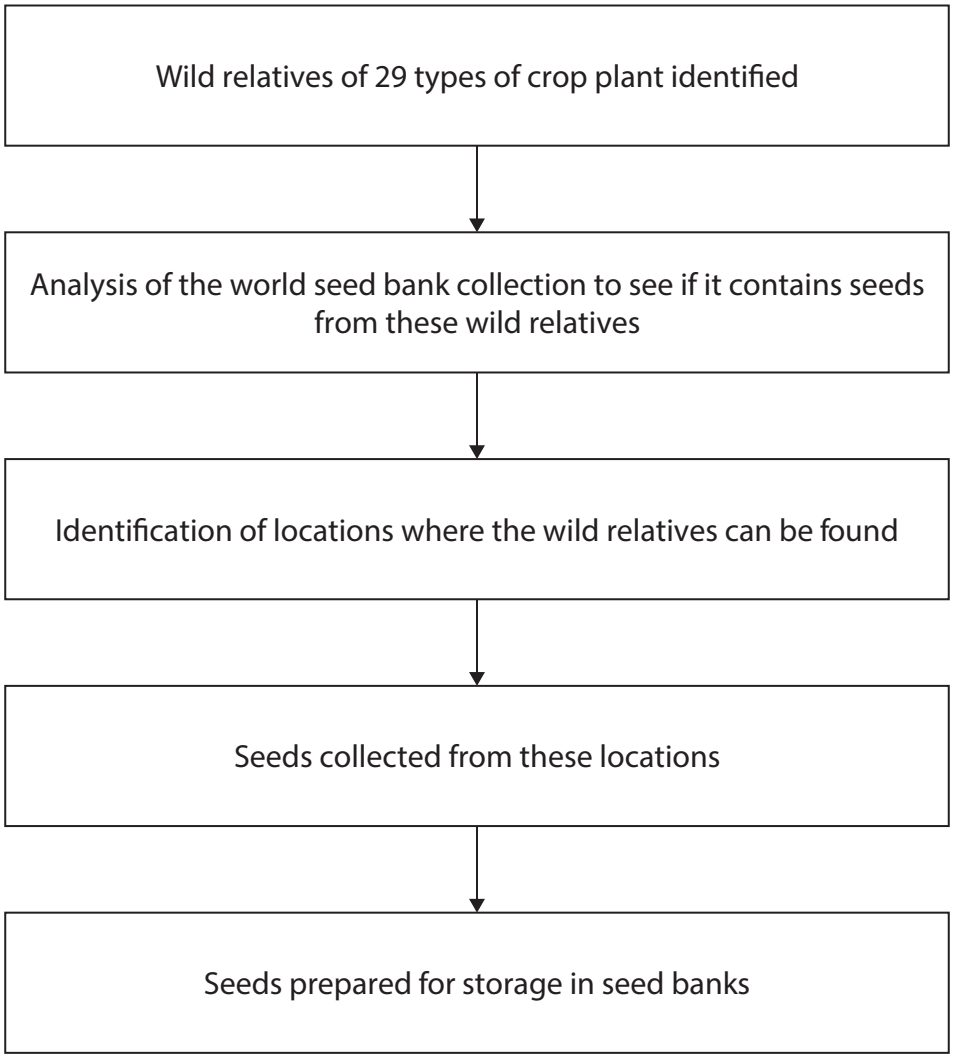
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6 Many countries collect seeds and store them in seed banks.

Scientists in 25 countries collaborated on a project called 'Crop wild relatives'.

Wild relatives are plants that are closely related to crop plants.

The flow chart summarises some of the steps involved in this project.



(a) (i) Explain the processes involved in preparing seeds for storage in a seed bank.

(2)

(ii) The scientists collected seeds from many individuals of the same plant species.

Explain why the scientists collected seeds from **many** individuals of the same plant species.

(2)

(b) In many parts of the world, alfalfa plants and soybean plants are grown for animal feed.

The table shows the nutrient content of the two animal feeds.

Component	Percentage content of animal feed (%)	
	Alfalfa	Soybean
Fat	11.3	2.0
Fibre	6.0	5.5
Protein	53.5	46.0

(i) Which is the ratio of the protein content in alfalfa feed to soybean feed?

(1)

☒ **A** 1 : 0.85

☒ **B** 1 : 0.91

☒ **C** 1.09 : 1

☒ **D** 1.16 : 1

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(ii) Which is the mass of fat in 300 g of alfalfa feed?

(1)

- ☒ **A** 6.0 g
- ☒ **B** 18.0 g
- ☒ **C** 33.9 g
- ☒ **D** 160.5 g

(iii) Alfalfa plant roots have nodules containing bacteria.

These bacteria supply the alfalfa plant with nitrates.

Nitrates are used by the plant to make proteins.

Name **one** other molecule that a plant makes using nitrogen from nitrates.

(1)

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*(c) Some land cannot be used for growing alfalfa or food crops due to low temperatures or low rainfall.

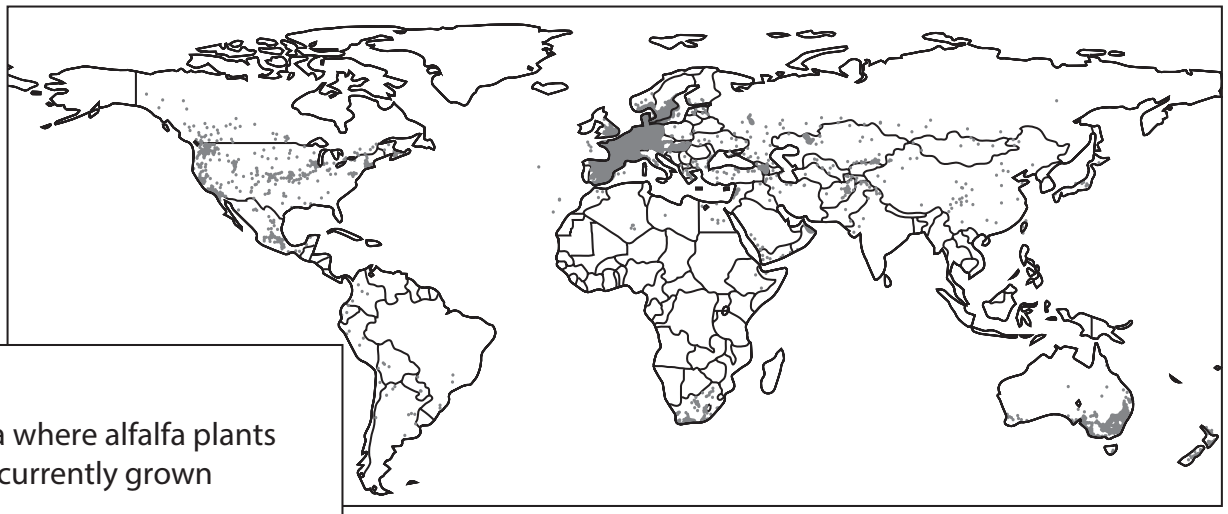
Scientists have used alfalfa plants and selected wild relatives in a breeding programme.

The alfalfa plants have a higher yield than the wild relatives as they grow larger and produce more seeds.

The wild relatives can grow in colder temperatures and in areas with lower rainfall.

Scientists have predicted that offspring that inherit all these chosen characteristics can be grown in different areas of the world.

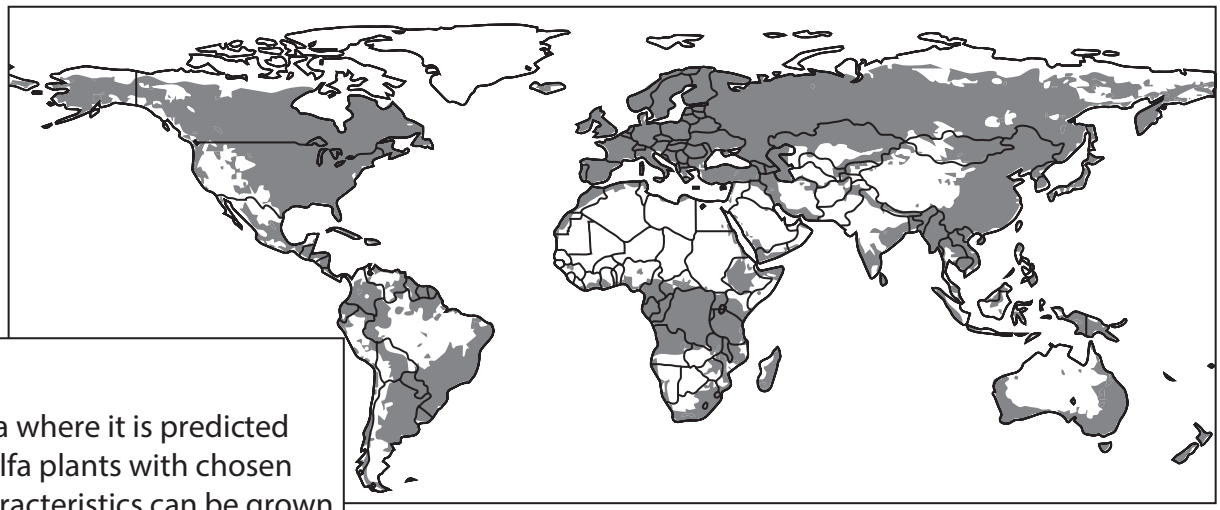
Map 1 shows areas where alfalfa is currently grown and map 2 shows areas where it is predicted that offspring with chosen characteristics can be grown.



Key

- area where alfalfa plants are currently grown
- area where alfalfa plants cannot be currently grown

Map 1



Key

- area where it is predicted alfalfa plants with chosen characteristics can be grown
- area where alfalfa plants cannot be grown

Map 2

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Discuss:

- how scientists could breed new varieties of alfalfa with **all** these chosen characteristics
- why farmers would choose to grow these new varieties for animal feed.

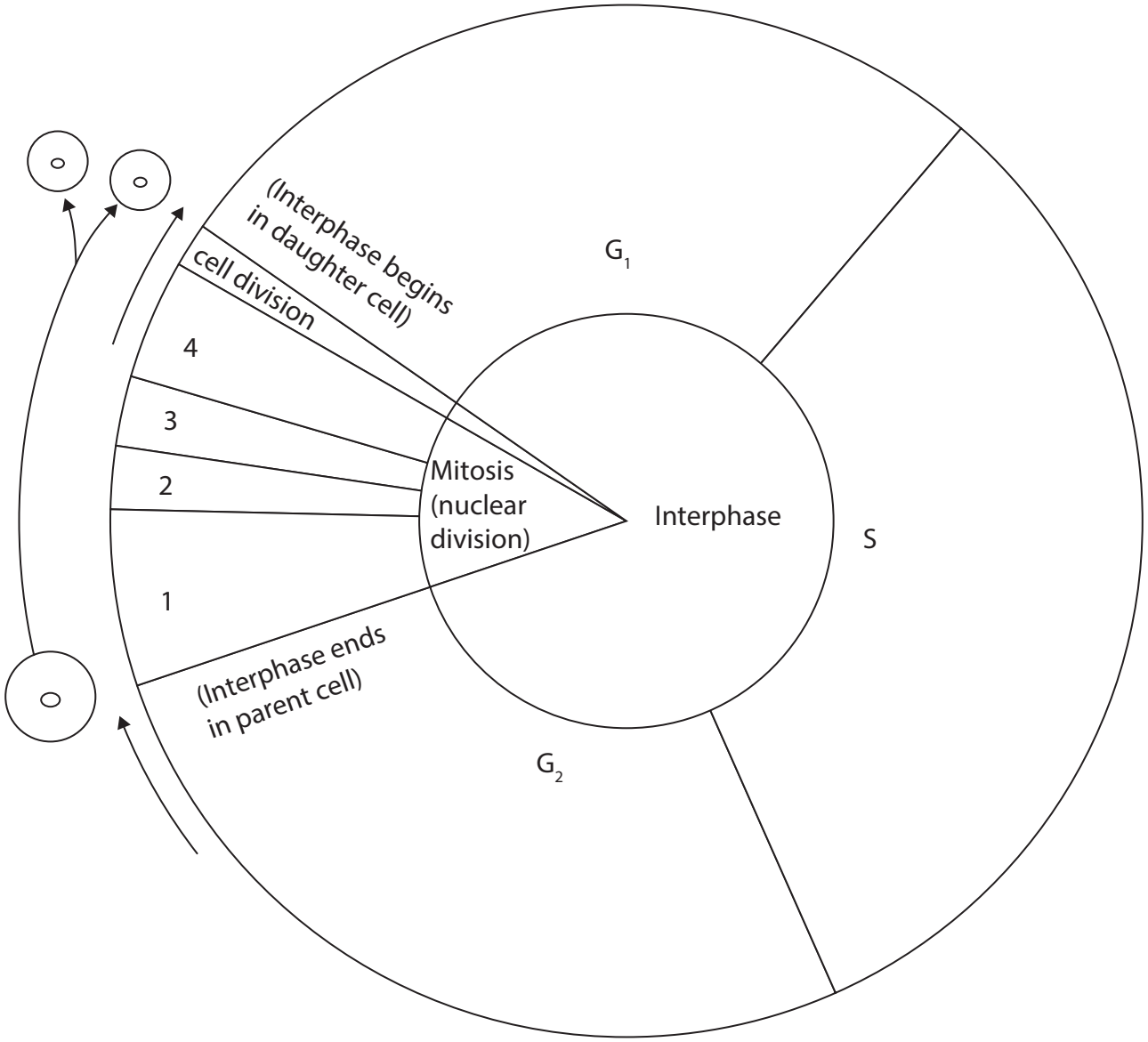
Use information from the whole of Question 6 and your own knowledge to support your answer.

(6)

(Total for Question 6 = 13 marks)

7 The cell cycle can be affected by DNA methylation.

The diagram shows the cell cycle.



Methylation of DNA and DNA replication occur in interphase.

(a) (i) State **one** other process that occurs in the nucleus during interphase.

(1)

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(ii) Compare and contrast the metaphase and the beginning of telophase stages of mitosis.

(3)

(b) Methylation of DNA can inhibit the production of mRNA.

Explain how DNA methylation could inhibit the production of mRNA.

(3)

*(c) Cell division occurs rapidly in cancer cells, forming a tumour.

The enzyme methyltransferase is involved in the process of DNA methylation.

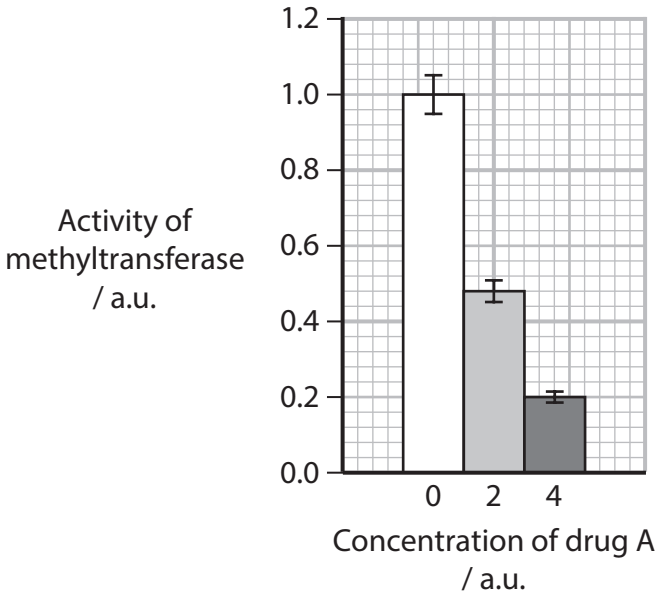
DNA methylation promotes the development of cancer tumours by inhibiting the production of mRNA from a tumour suppressor gene (TSG).

Proteins formed from active TSG can:

- inhibit DNA replication
- prevent the formation of spindle fibres.

Drug A is used to prevent the growth of tumours.

The graph shows the effect of the concentration of drug A on the activity of methyltransferase.



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Explain how drug A can prevent the growth of tumours.

Use information from all of Question 7 and your own knowledge to support your answer.

(6)

(Total for Question 7 = 13 marks)

8 It was once thought that a red panda and a giant panda were closely related because they have similar adaptations.

The photographs show a red panda and a giant panda.



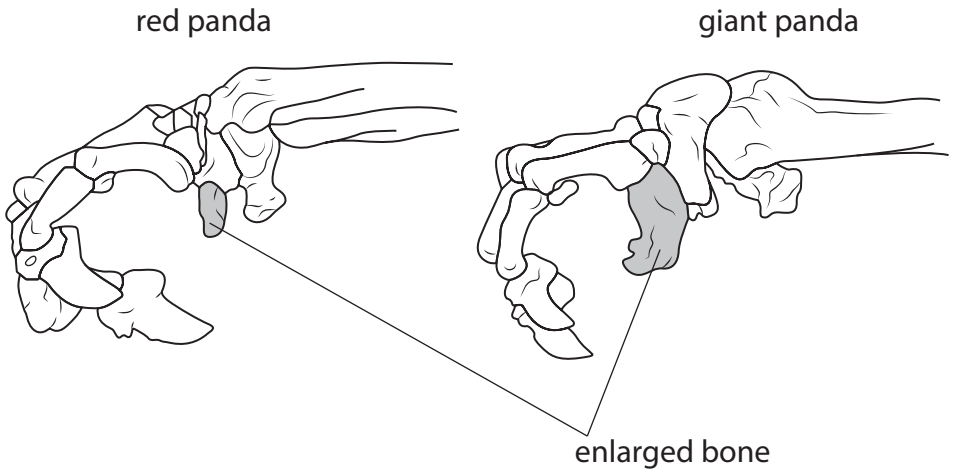
(Source: © Andrew Fox / Alamy Stock Photo)



(Source: © Ana Flašker / Alamy Stock Photo)

(a) One adaptation is an enlarged bone that acts as an extra thumb.

The diagram shows this adaptation.



(i) Which type of adaptation is shown in the diagram?

(1)

- ☒ **A** anatomical
- ☒ **B** behavioural
- ☒ **C** physiological
- ☒ **D** seasonal

(ii) Suggest why this adaptation is beneficial to these pandas.

(1)

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(b) The similarity between DNA sequences from four species was investigated.

Scientists calculated the 'stability unit' for each pair of species.

A lower stability unit means that the DNA sequences were more similar.

The table shows the results of this investigation.

Species	Stability unit			
	brown bear	giant panda	red panda	raccoon
brown bear		4.8	14.0	14.4
giant panda	4.8		14.4	14.7
red panda	14.0	14.4		13.9
raccoon	14.4	14.7	13.9	

New taxonomic groupings were based on this evidence including:

- the giant panda was moved into the taxonomic grouping that contained brown bears
- the red panda was moved into a separate taxonomic grouping to all the other species.

Explain why these two pandas were regrouped based on this data.

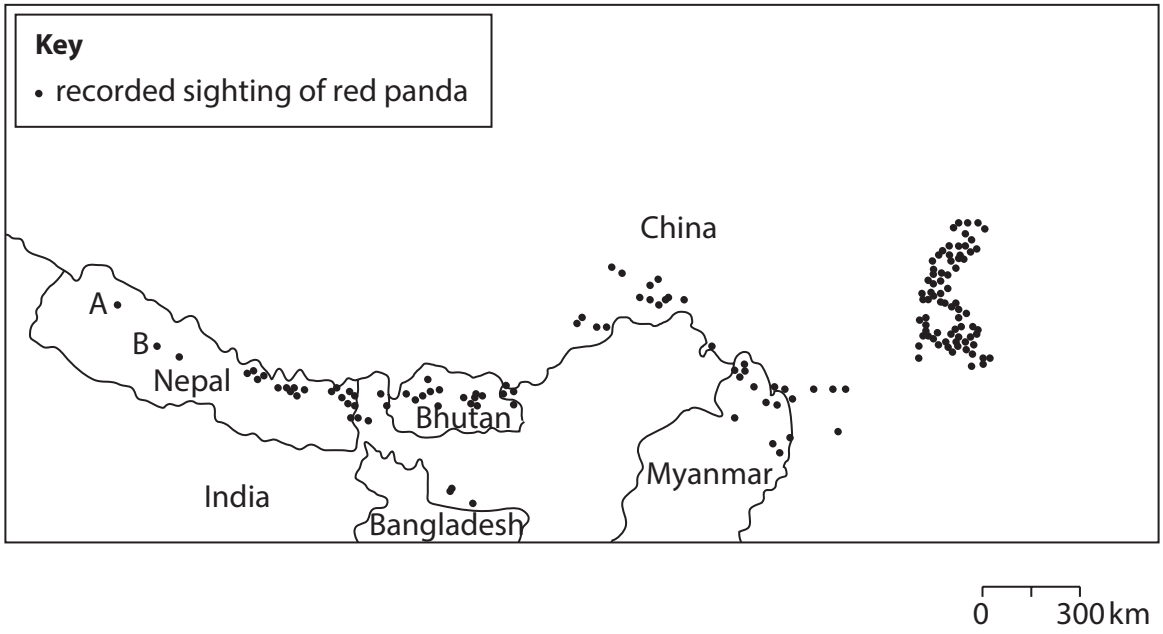
(2)

(c) The red panda is an endangered species.

Red pandas live in forests located on high mountains.

They eat bamboo leaves, fruits, insects and bird eggs.

The diagram shows the locations where red pandas have been seen over the past 100 years.



(i) Estimate the distance between the locations labelled A and B.

(1)

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(ii) Over the past decade, red pandas have been seen higher up the mountains than previously.

Suggest **two** reasons why red pandas are now seen higher up the mountains than previously.

(2)

1 .....

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2 .....

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(d) The genetic diversity of four populations of red panda born in captivity was investigated.

The mean number of alleles at one particular locus and the heterozygosity index were calculated.

The results are shown in the table.

Population	Mean number of alleles at one locus	Heterozygosity index
C	7	0.732
D	4	0.702
E	5	0.728
F	4	0.782

(i) Population **C** contained 41 individuals.

Calculate the number of heterozygotes in this population.

(1)

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(ii) Suggest how scientists could prevent loss of alleles from red panda population **C**.

(2)

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(e) (i) The Hardy–Weinberg equation was used to see whether a change in allele frequency was occurring in red panda populations over time for a different locus, with two alleles G and g.

The table shows some information about a population of 30 red pandas.

Genotype	GG	Gg	gg
Part of Hardy–Weinberg equation	p^2	2pq	q^2
Number of red pandas			

The frequency of the G allele for this population was calculated as 0.5476.

Complete the table to show the numbers of red pandas for each of the genotypes.

Use the equation

$$p^2 + 2pq + q^2 = 1$$

(3)

(ii) Explain how scientists would have used the Hardy–Weinberg equation to determine that there was a change in allele frequencies, at this locus, over time, in population **C**.

(2)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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