Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Tuesday 14 January 2020

Morning (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 **black** 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 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 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.

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 6 0 5 1 8 A 0 1 3 2

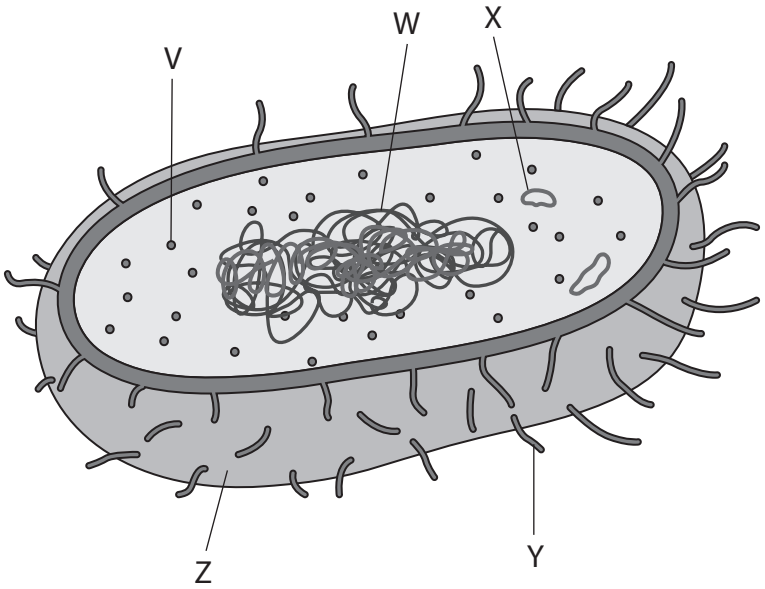
Pearson

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 The diagram shows a prokaryotic cell, drawn by a student.



(a) (i) Which labelled structure is a plasmid?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) Which labelled structure enables this cell to adhere to other bacterial cells in conjugation?

(1)

- ☒ **A** V
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(iii) State how ribosomes in prokaryotic cells are different from those in eukaryotic cells.

(1)

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(b) Prokaryotic cells may also have a capsule and a flagellum.

State **one** function of each of these structures.

(2)

Capsule .....

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Flagellum .....

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(Total for Question 1 = 5 marks)

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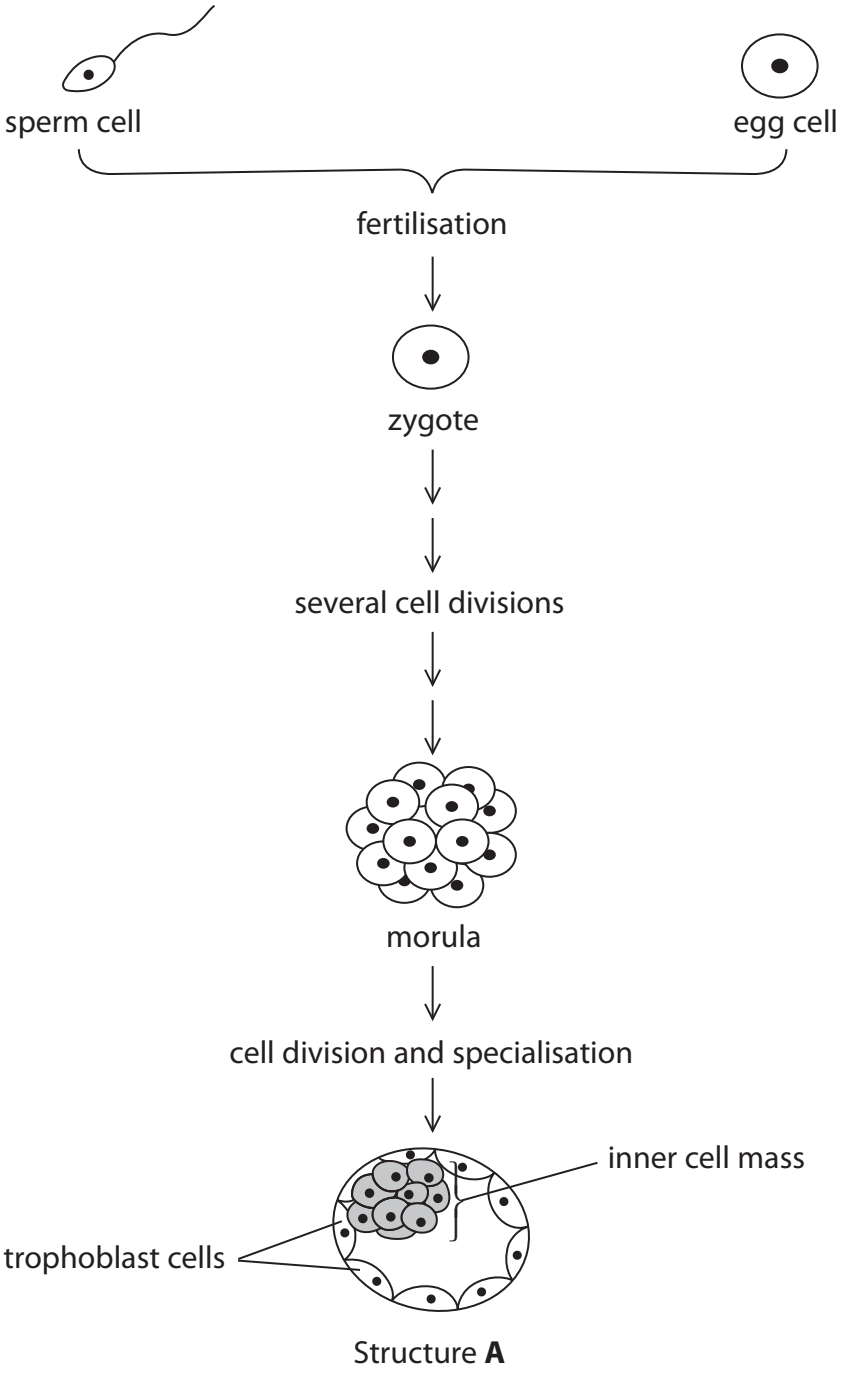
2 The diagram shows three structures that form after the fertilisation of an egg cell.



Structure **A**

(a) Explain why the cells in the morula are genetically identical.

(2)

(b) Structure **A** can be used as a source of pluripotent stem cells.

(i) Name structure **A**.

(1)

(ii) Stem cells can be used as a medical treatment when a patient has had a severe heart attack.

A severe heart attack can cause the death of heart muscle cells.

The medical treatment involves injecting stem cells into damaged areas of the heart muscle.

Suggest why injecting pluripotent stem cells may benefit a person who has had a severe heart attack.

(2)

(Total for Question 2 = 5 marks)

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3 Some of the characteristics of an organism are due to polygenic inheritance.

(a) The photograph shows some Chinese white kidney beans.

The mass of individual Chinese white kidney beans varies. This is partly due to polygenic inheritance.

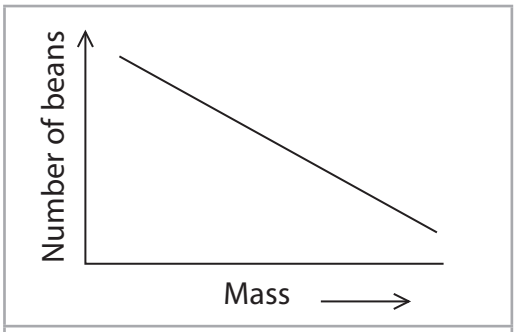
(i) State what is meant by the term **polygenic inheritance**.

(2)

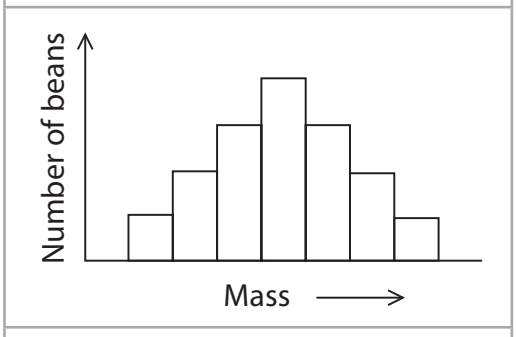
(ii) Which of the following graphs represents the distribution of mass of these beans?

(1)

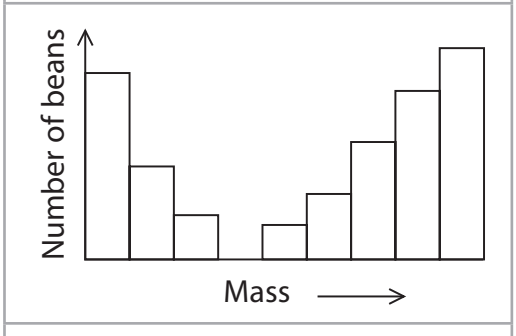
☒ **A**



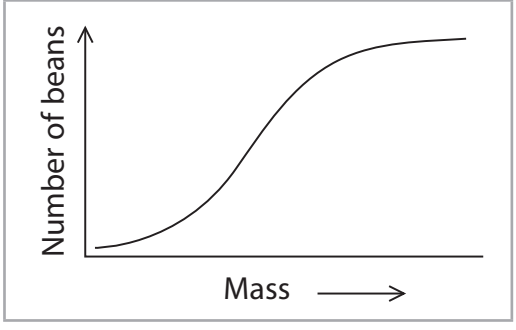
☒ **B**



☒ **C**



☒ **D**



(b) The inheritance of height is another example of polygenic inheritance.

It is possible to predict how tall children could become when they reach adulthood.

The prediction uses the following steps.

1. Add the mother's height (cm) to the father's height (cm).
2. Add 13 cm if the child is a boy or subtract 13 cm if the child is a girl.
3. Divide by two.

(i) A woman with a height of 1.59 m has a daughter. The father is 1.76 m tall.

Calculate the predicted adult height of their daughter.

(1)

Answer ..... m

(ii) Explain why their daughter may not grow to be this height.

(3)

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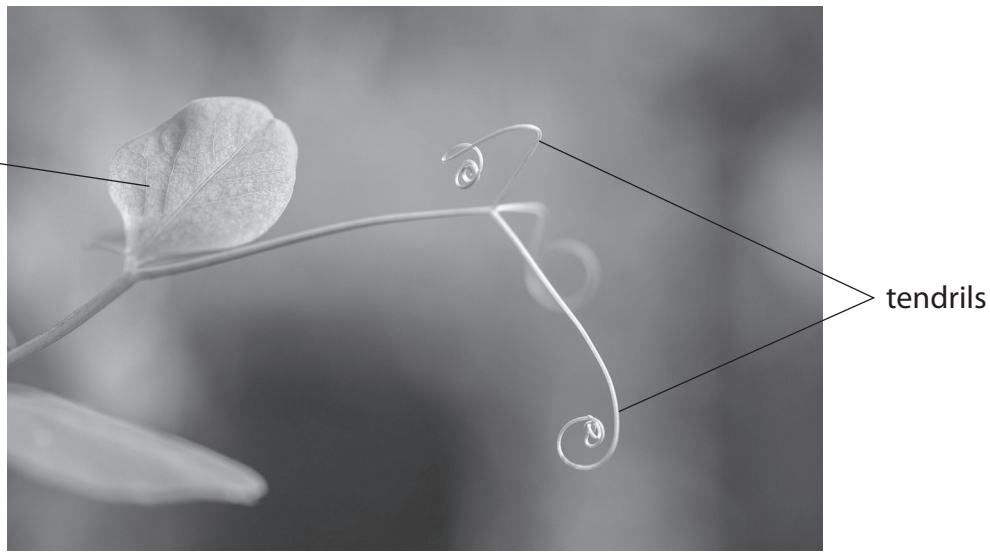
(Total for Question 3 = 7 marks)

4 Tendrils are produced by climbing plants, such as pea plants.

The photograph shows the tendrils on a growing pea shoot.



(Source: © Jerry Lin/Shutterstock)

A tendril is a modified leaf that can coil around anything it touches.

Cells in the tip of the tendril divide by mitosis.

(a) A student investigated the mitotic index of cells in the tips of tendrils.

Acetic orcein stain was added to the tissues from the tips of the tendrils.

(i) Give **one** reason why the cells were stained in this investigation.

(1)

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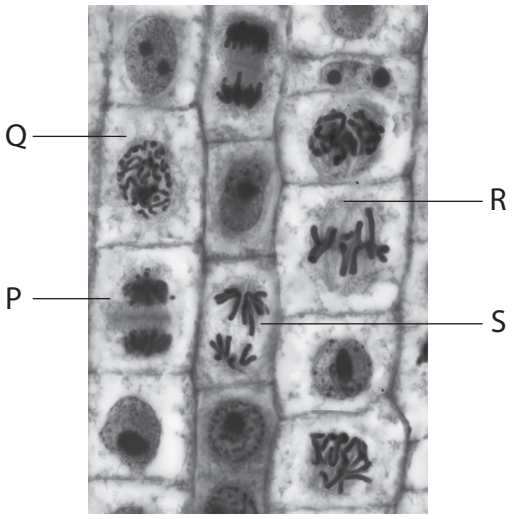
(ii) The photograph shows these cells, as seen using a light microscope.



(Source: © Steve Gschmeissner/Science Photo Library)

Which labelled cell is in the metaphase stage of mitosis?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** S

(iii) The table shows the results of this investigation.

Stage	Number of cells
Interphase	117
Prophase	15
Metaphase	3
Anaphase	10
Telophase	5

Calculate the mitotic index.

(2)

Answer .....

(b) Suggest the advantages of tendrils for the pea plant.

(3)

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(c) Pea plants produce flowers.

Some cells in the flowers undergo meiosis.

Explain how the separation of chromosomes in meiosis gives rise to genetic variation in the offspring of pea plants.

(3)

(Total for Question 4 = 10 marks)

5 The photograph shows a Madagascan pygmy kingfisher (*Ceyx madagascariensis*).

(Source: © Nature Picture Library/Alamy Stock Photo)

This kingfisher is endemic to forests in Madagascar.

The diet of this kingfisher is mainly frogs and insects.

(a) (i) State what is meant by the term **endemic** with reference to this kingfisher.

(1)

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(ii) State the domain in which this kingfisher is classified.

(1)

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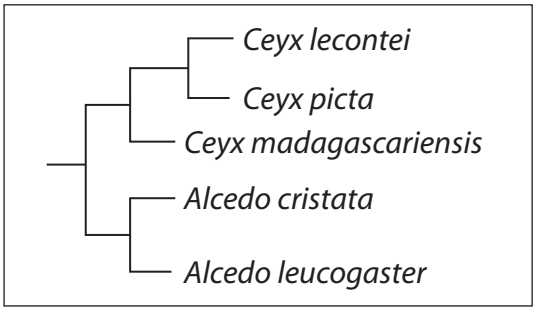
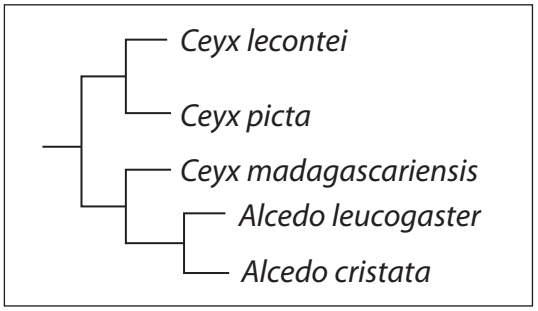
(b) A scientist recently collected new data about the classification of kingfishers, using molecular evidence.

The data were used to propose the reclassification of some kingfishers, including *Ceyx madagascariensis*.

The diagrams show an old classification and the proposed reclassification of five species of kingfishers.



Old classification



Proposed reclassification

(i) Using the proposed reclassification, explain which species of kingfisher are most closely related to *Ceyx madagascariensis*.

(2)

*(ii) Explain how molecular evidence led to the reclassification of species and how the scientific community would have reviewed the evidence before it was accepted.

Use the information in the photograph and the diagrams to support your answer.

(6)

(Total for Question 5 = 10 marks)

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6 The photograph shows kenaf plants growing on a farm in Nigeria.

(Source: © Design Pics Inc/Alamy Stock Photo)

Kenaf is grown mainly in parts of Africa and southern Asia.

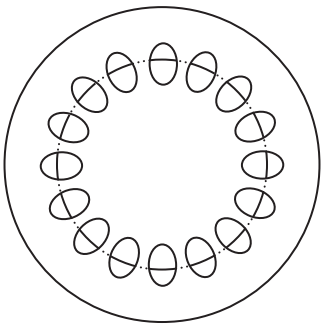
Fibres from the stems of these plants are used to make paper.

Fibres are obtained from the xylem and the phloem.

(a) (i) The diagram shows a transverse section through the stem of a plant.

Label the diagram to show the position of the xylem and the phloem.

(1)



(ii) Below are some statements about xylem and phloem.

- both tissues have a transport function
- xylem vessels contain sieve plates
- phloem transports polysaccharides
- xylem vessels can transport substances in both directions

How many of these statements are correct?

(1)

☒ **A** 1

☒ **B** 2

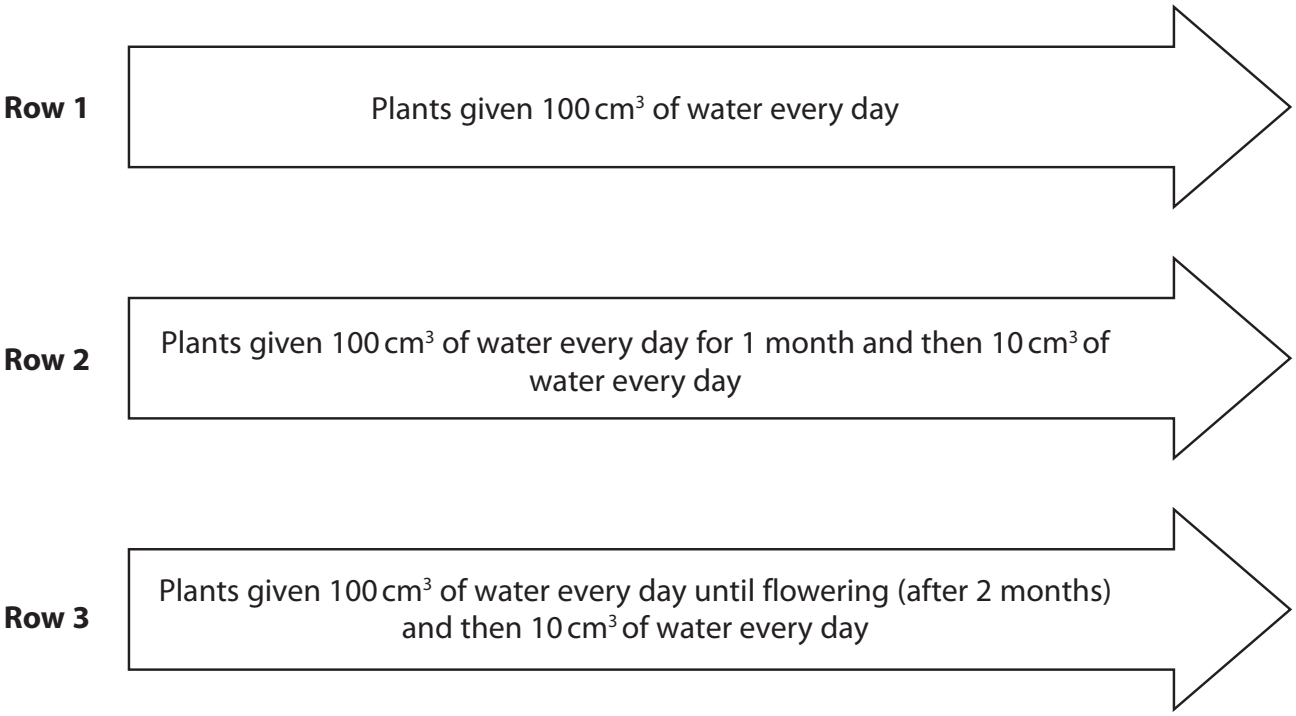
☒ **C** 3

☒ **D** 4

(b) When a plant is not given sufficient water for a period of time, it develops water stress.

In an investigation, three rows of kenaf plants were grown in separate containers in a glasshouse. The temperature, light intensity, soil quality and soil quantity were controlled.

The diagram shows how each row was treated.



The table shows the means and standard deviations of the measurements of the fibres extracted from the plants at the end of this investigation.

Row	Mean length / mm	Mean diameter / μm	Mean cell wall thickness / μm
1	0.91 ± 0.01	26.95 ± 0.45	3.44 ± 0.16
2	0.64 ± 0.06	21.62 ± 0.71	2.85 ± 0.08
3	0.81 ± 0.03	26.48 ± 0.77	3.23 ± 0.09

(i) Calculate the percentage decrease in the mean diameter of the fibres from plants in row 2 compared with those from plants in row 1.

(3)

Answer .....%

(ii) Comment on the results of this investigation.

Use the information in the table to support your answer.

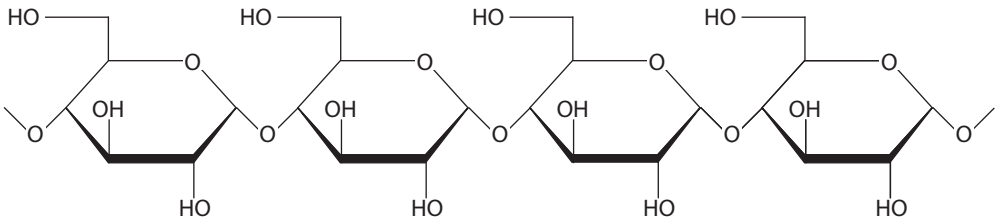
(4)

(c) The walls of xylem vessels contain cellulose.

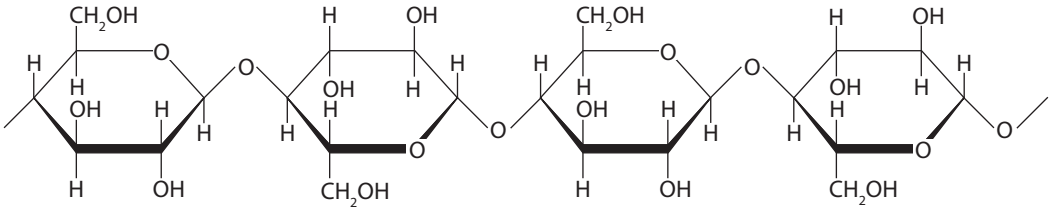
Which of the following shows the structure of part of a cellulose molecule?

(1)

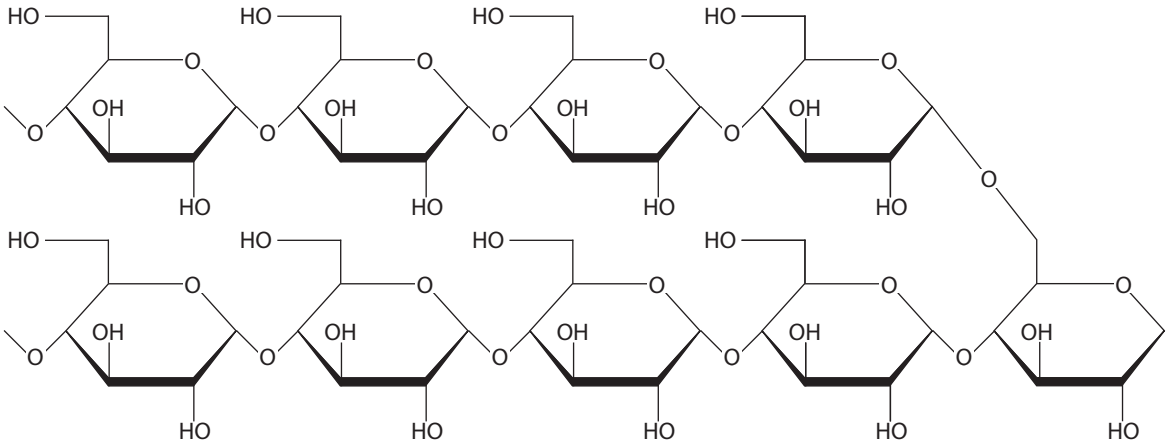
☒ **A**



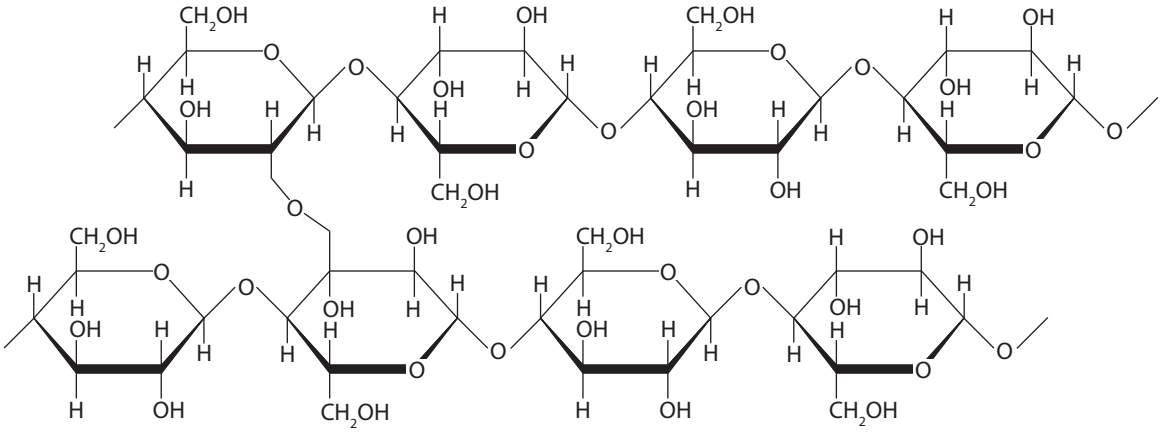
☒ **B**



☒ **C**



☒ **D**



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(d) Explain how xylem vessels are adapted for support and transport.

(4)

Support .....

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Transport .....

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(Total for Question 6 = 14 marks)

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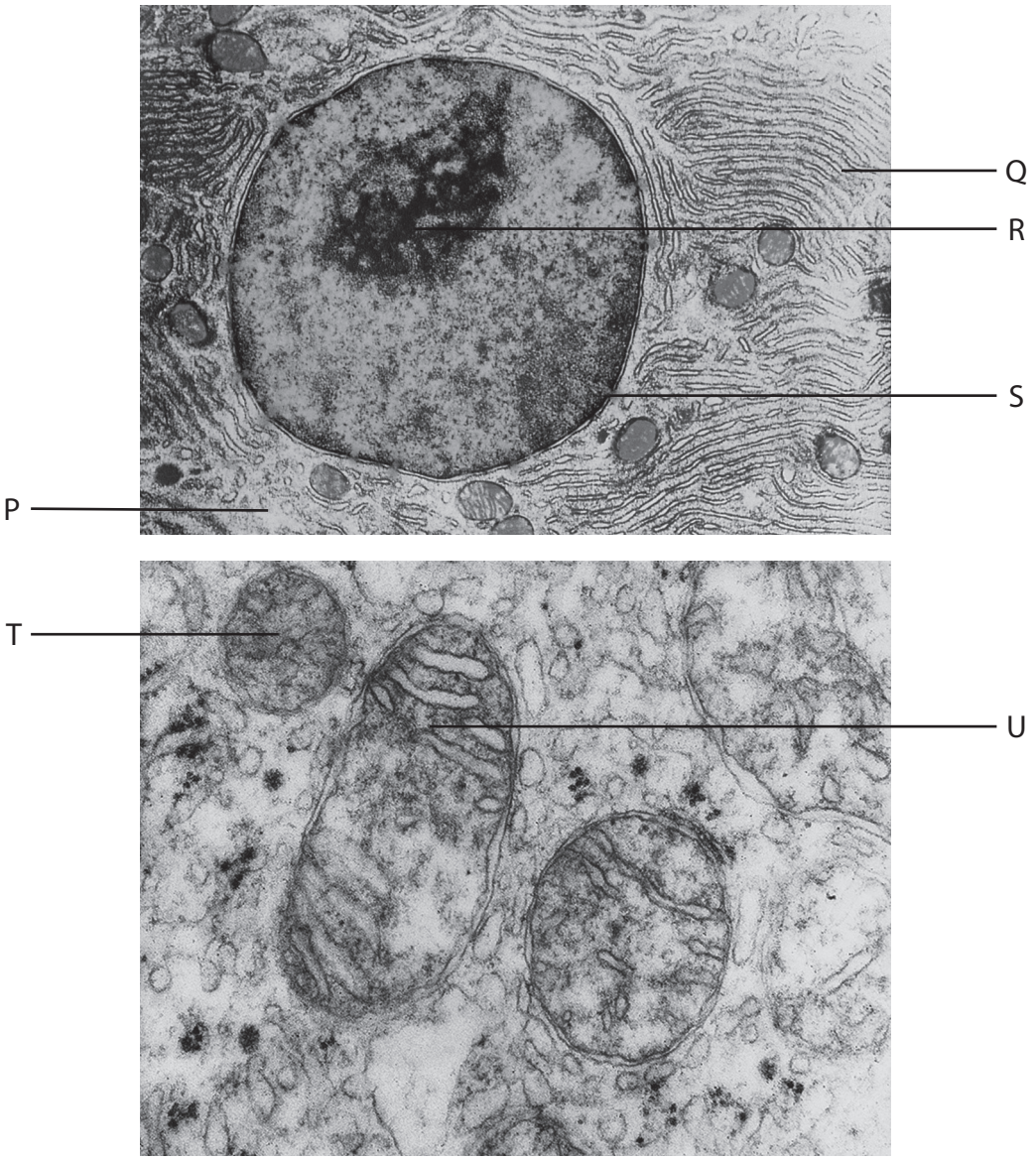
7 Insulin is a protein produced in beta cells in the pancreas.

Ribosomes are involved in the production of insulin.

(a) The photographs show part of a beta cell from the pancreas, as seen using an electron microscope.



(Source: © Don Fawcett/Science Photo Library
© Martin M. Rotker/Science Photo Library)

(i) Which labelled structure produces ribosomes?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) The structures labelled T and U are the same type of organelle.

Suggest why these structures look different in this photograph.

(2)

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(iii) A student measured the length of the structure labelled U as 52 mm.

The actual length of this structure is 3.0 μm.

Calculate the magnification of this electron microscope image.

(2)

Answer .....

(b) Describe how the protein insulin is transported from the ribosomes and then secreted by a beta cell.

(5)

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(c) Explain why beta cells can produce insulin but other cells in the pancreas do not.

(5)

(Total for Question 7 = 15 marks)

8 The photograph shows a river and mangrove trees in Bhitarkanika National Park in India.

(Source: © Mariano Gaspar/Shutterstock)

(a) (i) The biodiversity of this area of Bhitarkanika National Park could be measured by calculating species richness.

Which of the following describes species richness in Bhitarkanika National Park?

(1)

☒ **A** the number of animal species

☒ **B** the number of plant species

☒ **C** the number of organisms in each of the species

☒ **D** the number of species

(ii) Describe **one** other way in which the biodiversity of this area of Bhitarkanika National Park could be measured.

(2)

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(b) Saltwater crocodiles are found in the rivers in this area.

The numbers of this endangered species have decreased over the past 40 years.

Explain the possible causes of this decrease.

(3)

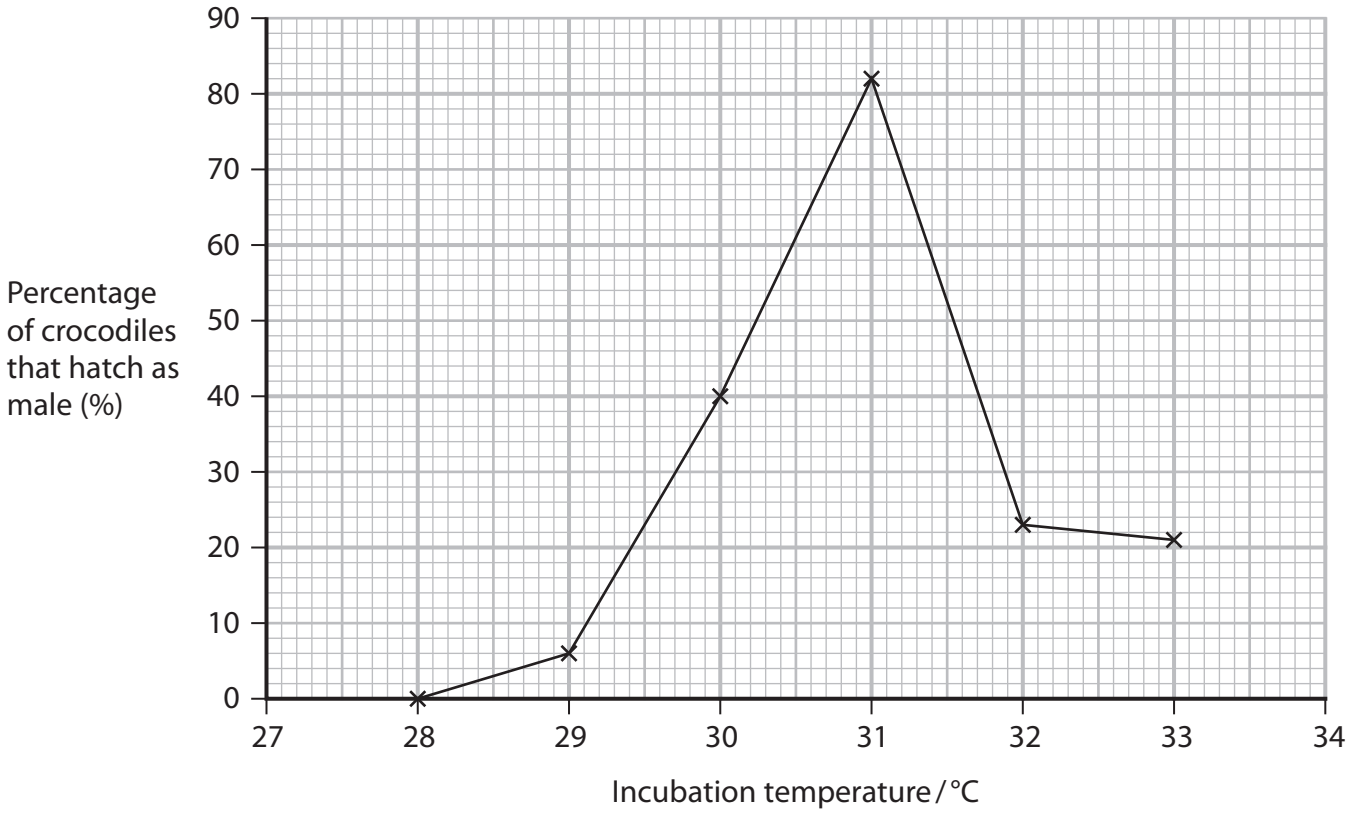
(c) Scientists are involved in conservation projects to increase the numbers of endangered saltwater crocodiles, without causing a reduction in the genetic diversity of future populations.

One project involves collecting the eggs from nests in different parts of Bhitarkanika National Park. The eggs are incubated at a suitable temperature.

The incubation temperature influences the sex of the developing crocodiles.

The crocodiles are released into the park when they have hatched.

The graph shows the effect of temperature on the percentage of crocodiles that hatch as male.



(i) Calculate the number of female crocodiles that would develop from 350 eggs incubated at 32 °C.

(2)

Answer .....

*(ii) Explain how this project could increase the number of crocodiles rapidly, without reducing the genetic diversity of future populations in Bhitarkanika National Park.

Use the information in the graph to support your answer.

(6)

(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

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