Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

Candidate Number

Friday 24 May 2019

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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1/1/1/1/1/1/

P 6 1 4 7 0 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 Mineral ions are transported by xylem vessels.

The photograph shows a section through part of the stem of a plant, as seen using a light microscope.
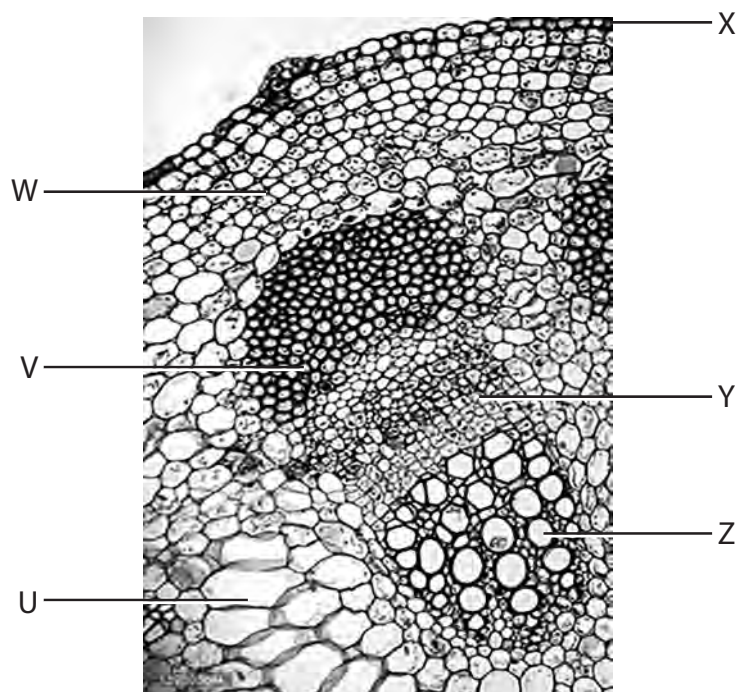
(a) (i) Which letter identifies a xylem vessel?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) Which letter identifies a sclerenchyma fibre?

(1)

☒ **A** U

☒ **B** V

☒ **C** W

☒ **D** Z

(b) The graph shows the concentrations of three inorganic ions in the xylem of a plant.

Concentration of inorganic ions in xylem / mmol dm^{-3}
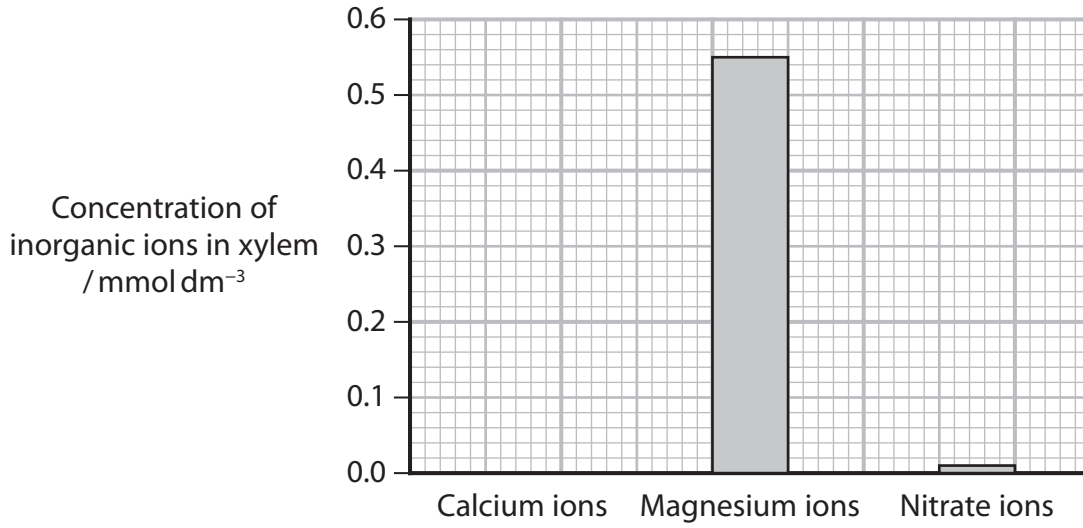
(i) The concentration of calcium ions is 0.45 mmol dm^{-3}.

Plot this concentration on the graph.

(1)

(ii) Explain the importance of each of these ions to the plant.

(3)

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(Total for Question 1 = 6 marks)

2 Farmers sometimes spray herbicides on their fields. Herbicides kill plants that the farmer does not want to grow.

The effect of the concentration of herbicide on the number of species of insects in three fields was investigated.

The mean number of species for the three fields was calculated.

The graph shows the results of this investigation.

Concentration of herbicide / mg dm^{-3}
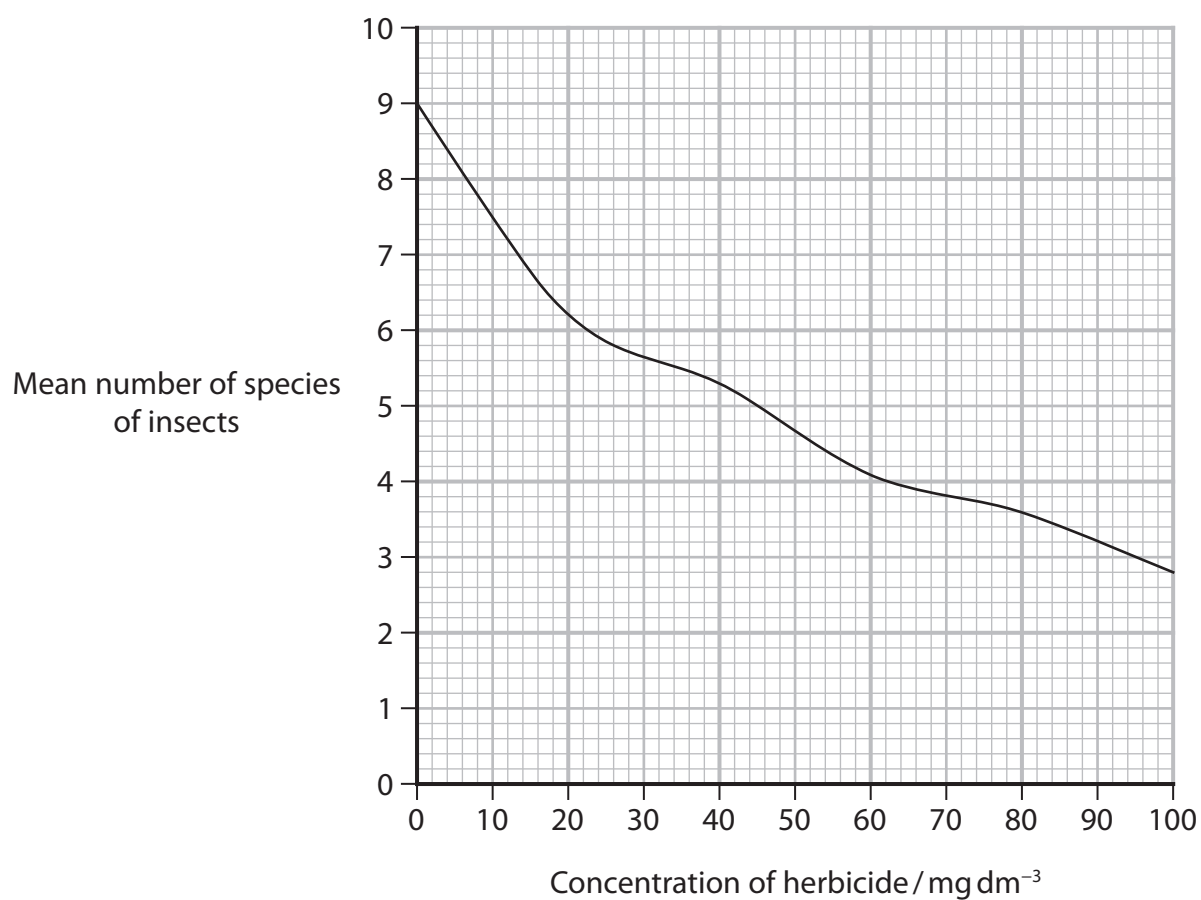
(a) State what is meant by the term species.

(1)

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(b) Explain the relationship between the concentration of herbicide and the mean number of species of insects in the three fields.

Use the information in the graph to support your answer.

(4)

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(Total for Question 2 = 5 marks)

P 6 1 4 7 0 A 0 5 3 2

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P 6 1 4 7 0 A 0 6 3 2

3 Meiosis and mitosis are involved in cell division.

(a) Meiosis produces gametes that are genetically different.

Crossing over is important to increase genetic variation.

The diagram shows one pair of homologous chromosomes during early meiosis.

crossing over occurs here
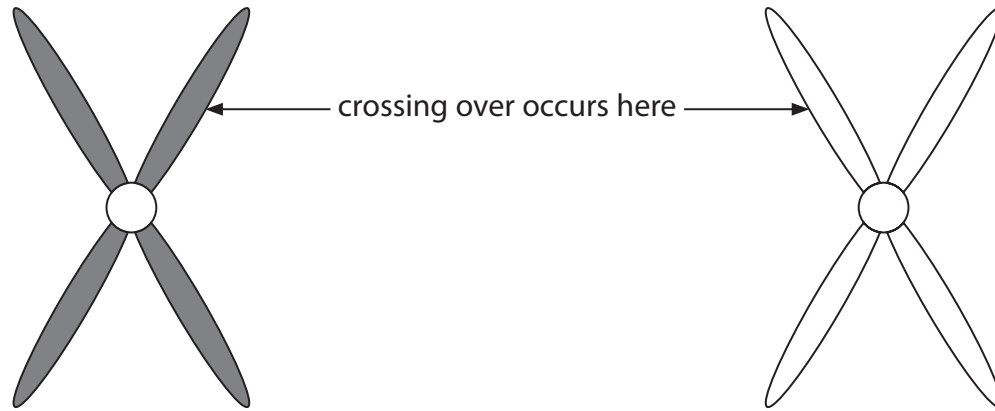
Complete the diagram below to show these chromosomes after crossing over has occurred.

(2)

(b) The photograph shows some cells undergoing mitosis.

Each labelled cell is in a different stage of mitosis.
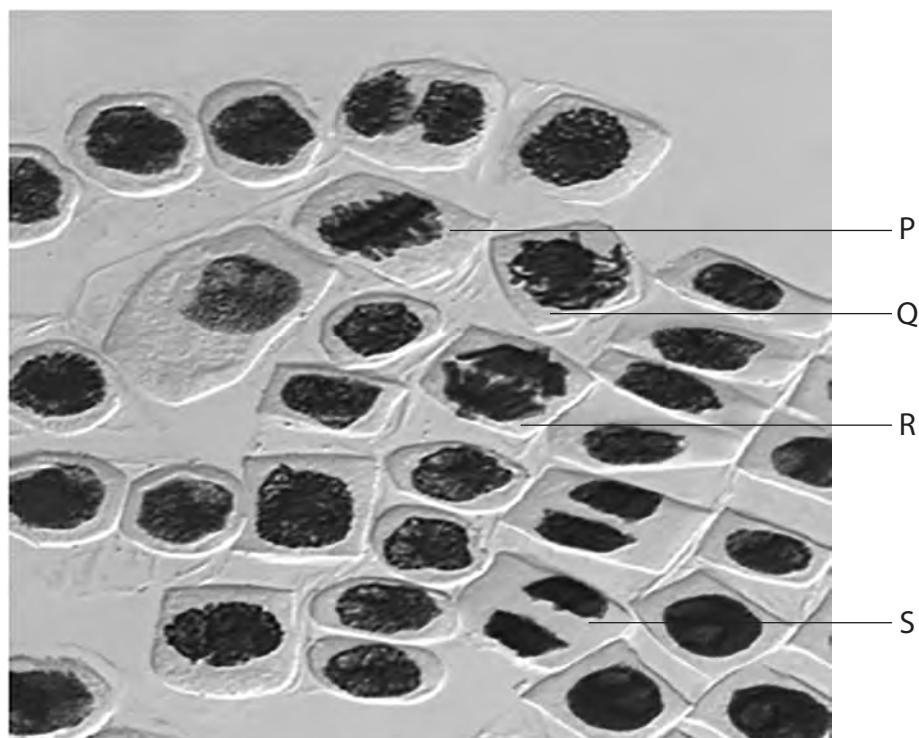
(i) Which cell is in prophase?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) In some embryo cells, interphase can last an average of nine hours.

The diagram shows the relative proportions of time spent in each part of the cell cycle.

cytokinesis (15°)

mitosis (75°)

interphase (270°)
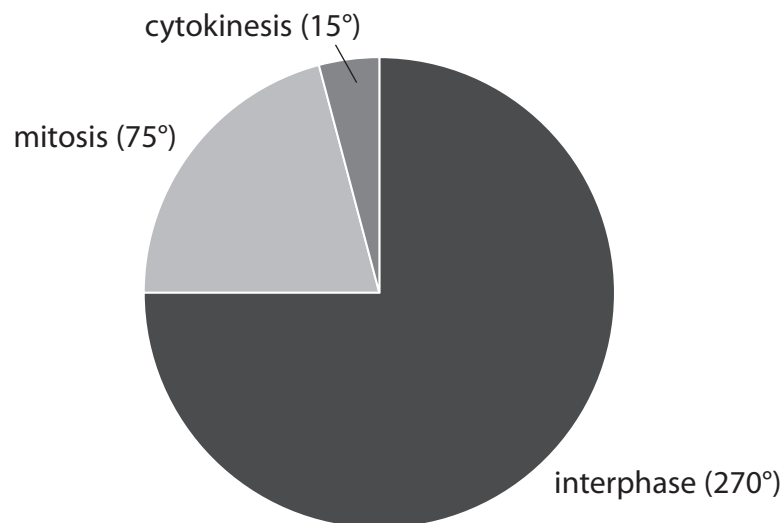
Calculate how long cytokinesis would take in these embryo cells.

(1)

Answer .... hours

(iii) Calculate the total number of cells resulting from one cell dividing by mitosis eight times.

(1)

Answer ....

Turn over ▶

P 6 1 4 7 0 A 0 9 3 2

(c) Ewing's sarcoma is a type of cancer.

Resveratrol, SRT1720 and Vincristine are drugs used to kill cancer cells.

An investigation was carried out to determine the most effective treatment for patients with Ewing's sarcoma.

The graph shows the results of this investigation.
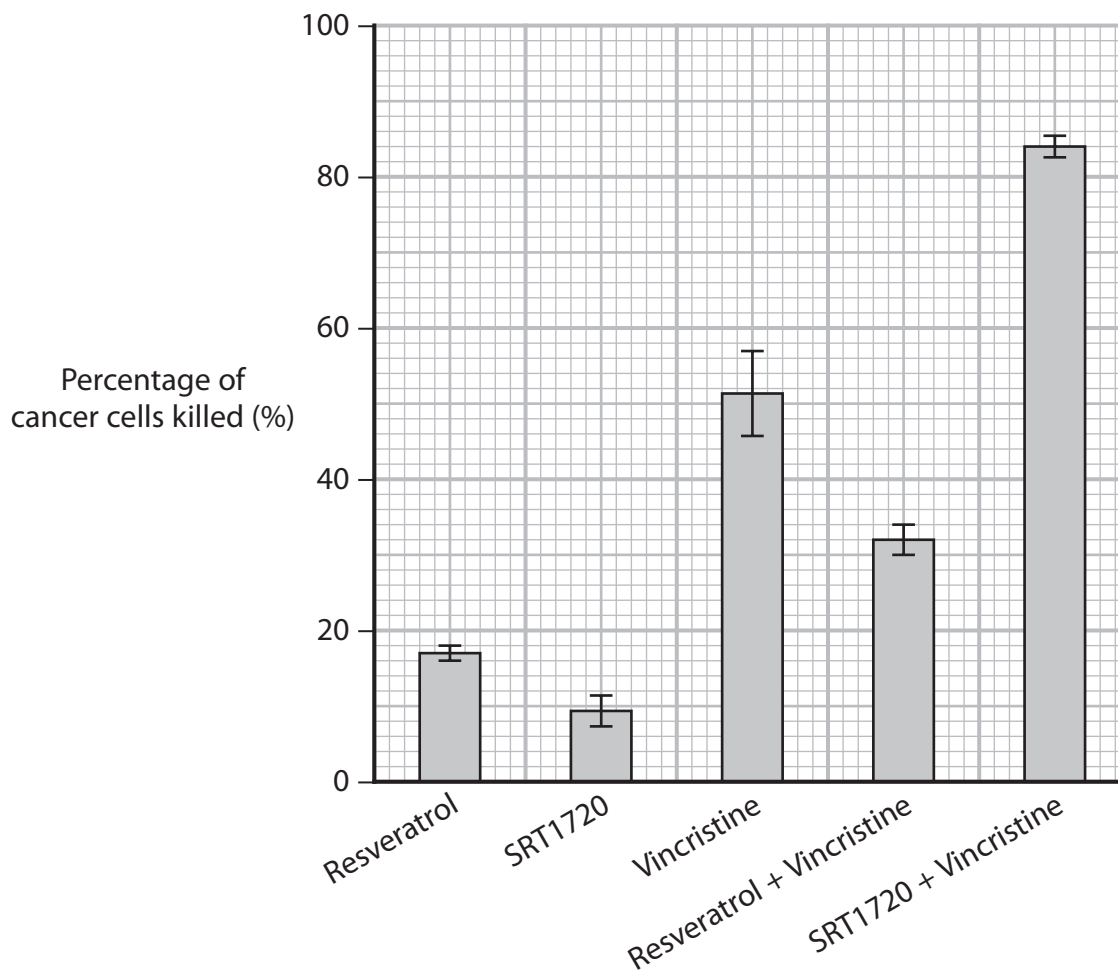
(i) Vincristine prevents spindle fibres from shortening during mitosis. This leads to the death of the cell.

At which stage of mitosis do the spindle fibres contract?

(1)

☒ **A** anaphase

☒ **B** metaphase

☒ **C** prophase

☒ **D** telophase

(ii) Evaluate the effectiveness of the three drugs used in this investigation.

Use the information in the graph to support your answer.

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(Total for Question 3 = 10 marks)

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4 The pancreas is an organ with many functions.

A student observed some cells of the pancreas using an electron microscope.

The student described one organelle that was seen as

> "several curved membrane-bound sacs of decreasing size".

(a) (i) Which organelle was seen?

(1)

- ☒ **A** centriole
- ☒ **B** Golgi apparatus
- ☒ **C** rough endoplasmic reticulum
- ☒ **D** smooth endoplasmic reticulum

(ii) Explain why this organelle cannot be seen using a light microscope.

(2)

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(iii) Give **two** differences between an organ and a tissue.

(2)

1..

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P 6 1 4 7 0 A 0 1 3 3 2

(b) Plant cells can also be studied using an electron microscope.

Name **two** structures present in animal cells that are not present in a plant cell.

(2)

1 ....

2 ....

(c) Cells in the pancreas use amino acids to synthesise polypeptides.
These cells also secrete enzymes and glycoproteins into the small intestine.

Cells from the pancreas, containing amino acids labelled with a fluorescent marker, were used in an investigation. The fluorescent marker looked green when seen with a special microscope.

The percentage of green fluorescence inside and outside the cells was measured at the start and after 60 minutes.

The results of this investigation are shown in the table.

Time / min	Percentage of green fluorescence (%)	
	Inside the cells	Outside the cells
0	100	0
60	38	62

Explain the results of this investigation.

(4)

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(Total for Question 4 = 11 marks)

5 There are more than 100 species of trees and shrubs around the world with the common name of 'ironwood'.

One type of ironwood tree, *Tabebuia avellanedae*, is native to South America.

Chemicals from these trees have antibacterial properties.

(a) (i) State the genus to which this plant belongs.

(1)

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(ii) Which structure in the cells of this plant stores starch?

(1)

☒ **A** amyloplast

☒ **B** middle lamella

☒ **C** plasmodesmata

☒ **D** tonoplast

(b) Plague is a disease caused by *Yersinia pestis* bacteria.

Every year, thousands of people around the world are infected with these bacteria.

These bacteria have a thick slime capsule and many pili.

(i) State the function of each of these structures.

(2)

Slime capsule ....

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Pili ....

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*(ii) The ironwood tree has wood containing chemical compounds called naphthoquinones. These compounds have antibacterial properties.

Scientists are investigating whether these compounds could be used to develop a drug to treat people infected with *Y. pestis*.

Describe the methods that would be used to trial a drug containing these compounds.

(6)

(Total for Question 5 = 10 marks)

P 6 1 4 7 0 A 0 1 7 3 2

6 One of the aims of seed banks is to maintain genetic diversity.

Seeds are stored in the Navdanya Seed Vault, one of over a hundred seed banks in India. This seed bank stores over 4000 varieties of rice.

The photograph shows some of these varieties of rice.
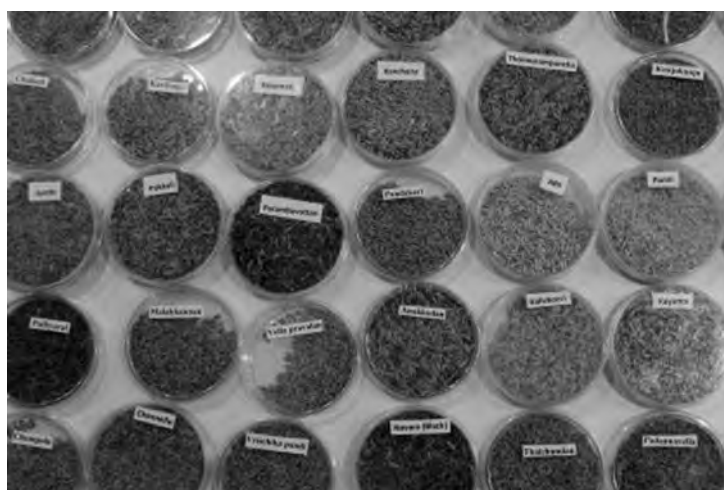
(a) (i) Which of the following can be used to calculate genetic diversity?

(1)

☒ **A** Hardy–Weinberg equation

☒ **B** heterozygosity index

☒ **C** index of diversity

☒ **D** mitotic index

(ii) Give **two** differences between genetic diversity and species richness.

(2)

1 ....

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2 ....

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(b) Suggest **two** reasons why seed banks store seeds instead of growing whole plants.

(2)

1 ....

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(c) Bananas are a popular food and seed banks are involved in the development of disease-resistant varieties.

The table shows the mass of bananas imported by three countries in 2007 and in 2011.

Country	Mass imported in 2007 / tonnes $\times$ 10^5	Mass imported in 2011 / tonnes $\times$ 10^5
China	3.3	8.2
Iran	6.3	6.2
Japan	9.8	1.1

(i) Calculate the percentage increase in the mass of bananas imported by China.

(2)

Answer ....%

(ii) Banana plants can reproduce asexually.

Most of the bananas grown by farmers around the world are clones from a single parent banana plant called 'The Cavendish'.

The diagram shows a parent banana plant and two clones of this parent plant.

parent plant

clones of parent plant

roots
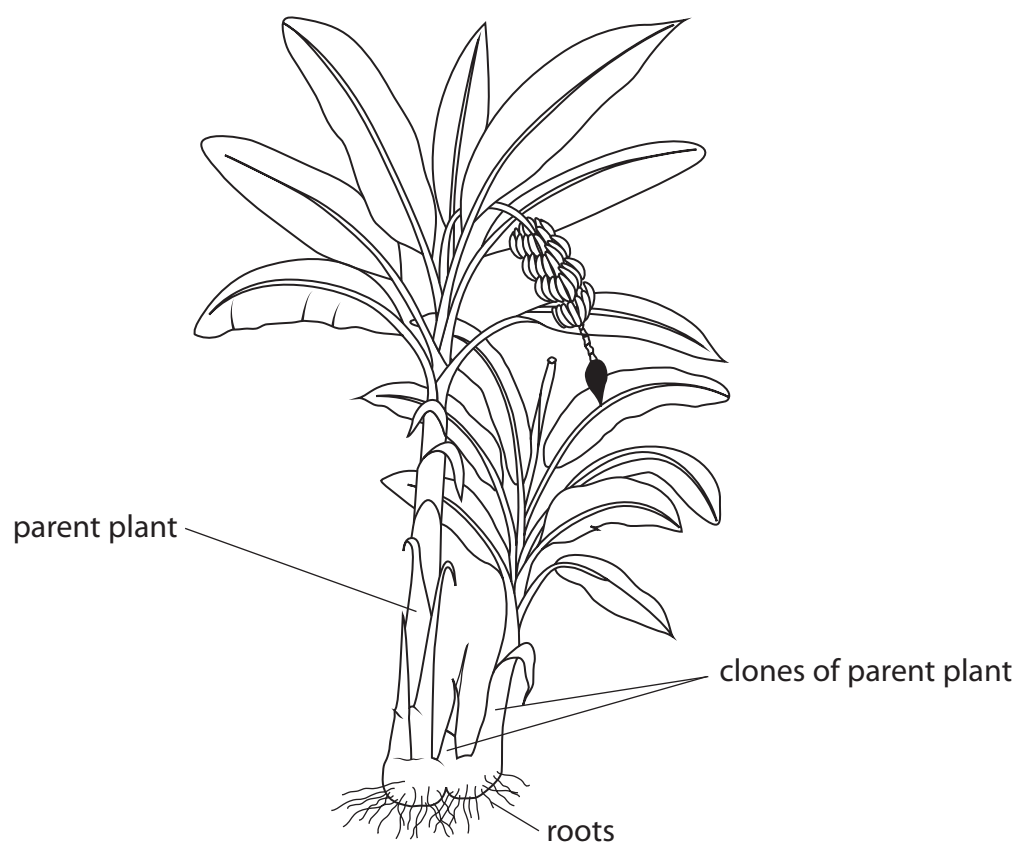
These clones can be removed from the parent plant and grown into new banana plants.

Panama disease is caused by a fungus. It has destroyed Cavendish banana plants in the Philippines. Cavendish banana plants are not resistant to this fungus.

Seed banks around the world have seeds from different varieties of banana.

Scientists are trying to improve the Cavendish banana by breeding it with different varieties of banana.

P 6 1 4 7 0 A 0 2 0 3 2

Explain why scientists are breeding the Cavendish banana with different varieties of banana.

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(Total for Question 6 = 11 marks)

P 6 1 4 7 0 A 0 2 1 3 2

7 A sperm cell is a specialised cell.

(a) The diagram shows a sperm cell.

W   X   Y   Z

60 μm
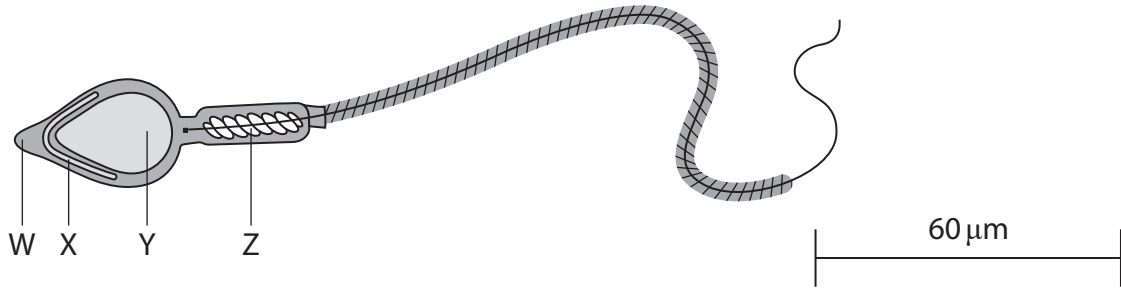
(i) How many of the labelled structures contain DNA?

(1)

☒ **A** 1

☒ **B** 2

☒ **C** 3

☒ **D** 4

(ii) Sperm cells contain mitochondria.

Describe the function of mitochondria in the movement of sperm cells.

(2)

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P 6 1 4 7 0 A 0 2 2 3 2

(iii) Calculate the magnification of the sperm cell shown in the diagram.

(2)

Answer ....

P 6 1 4 7 0 A 0 2 3 3 2

(b) The photograph shows a Chinese hamster.

Magnification ×1

A female Chinese hamster mates with many males in a short period of time.

The diagram shows the relative size of a Chinese hamster sperm cell compared with a human sperm cell.

human sperm cell

Chinese hamster sperm cell
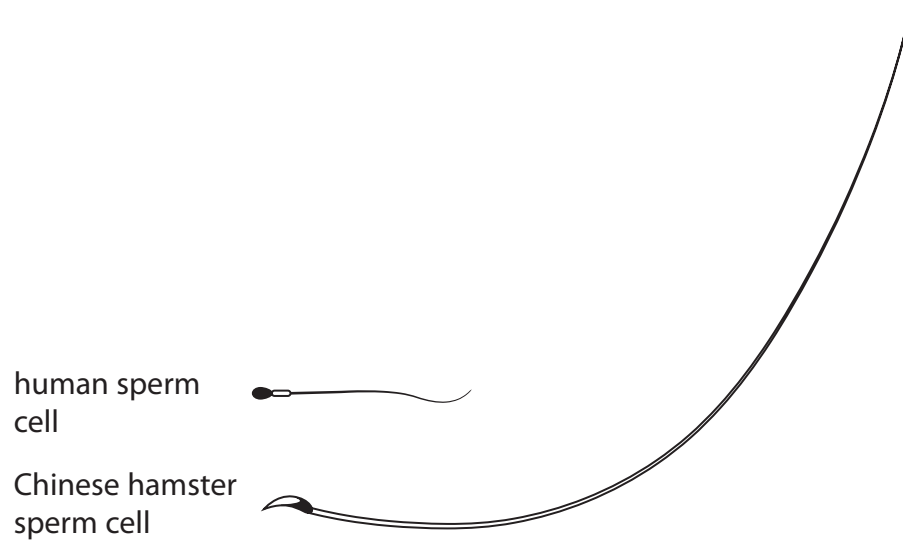
Suggest why the Chinese hamster sperm cell has such a long flagellum.

(3)

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(c) Explain the role of the cortical reaction in the process of fertilisation in mammals.

(3)

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(d) After fertilisation, the egg cell divides by mitosis to form a blastocyst.

During this process, totipotent cells become pluripotent.

Describe how a totipotent stem cell becomes a pluripotent stem cell.

(3)

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(Total for Question 7 = 14 marks)

P 6 1 4 7 0 A 0 2 5 3 2

8 Beavers were hunted to extinction in Scotland in the 16th century.

In mainland Europe, populations of beavers have become isolated from each other.

In 2009, 11 beavers were reintroduced to Scotland from Norway.

Beavers are adapted to live on land and in water. They can cut down trees. They gnaw branches from trees, which they use to build dams.

The photograph shows two beavers and a pond that has been created due to a beaver dam.

(a) Explain how the reintroduction of beavers resulted in a change in the biodiversity in Scotland.

(4)

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*(b) Some scientists were concerned that the low numbers of beavers reintroduced into Scotland from Norway could affect the genetic diversity of the population in Scotland.

The scientists proposed two solutions to this concern:

● to introduce more beavers from Norway

● to introduce beavers from several different European locations.

The map shows locations of European beavers before they were reintroduced to Scotland.

Norway

Scotland

Key

Location of European beavers
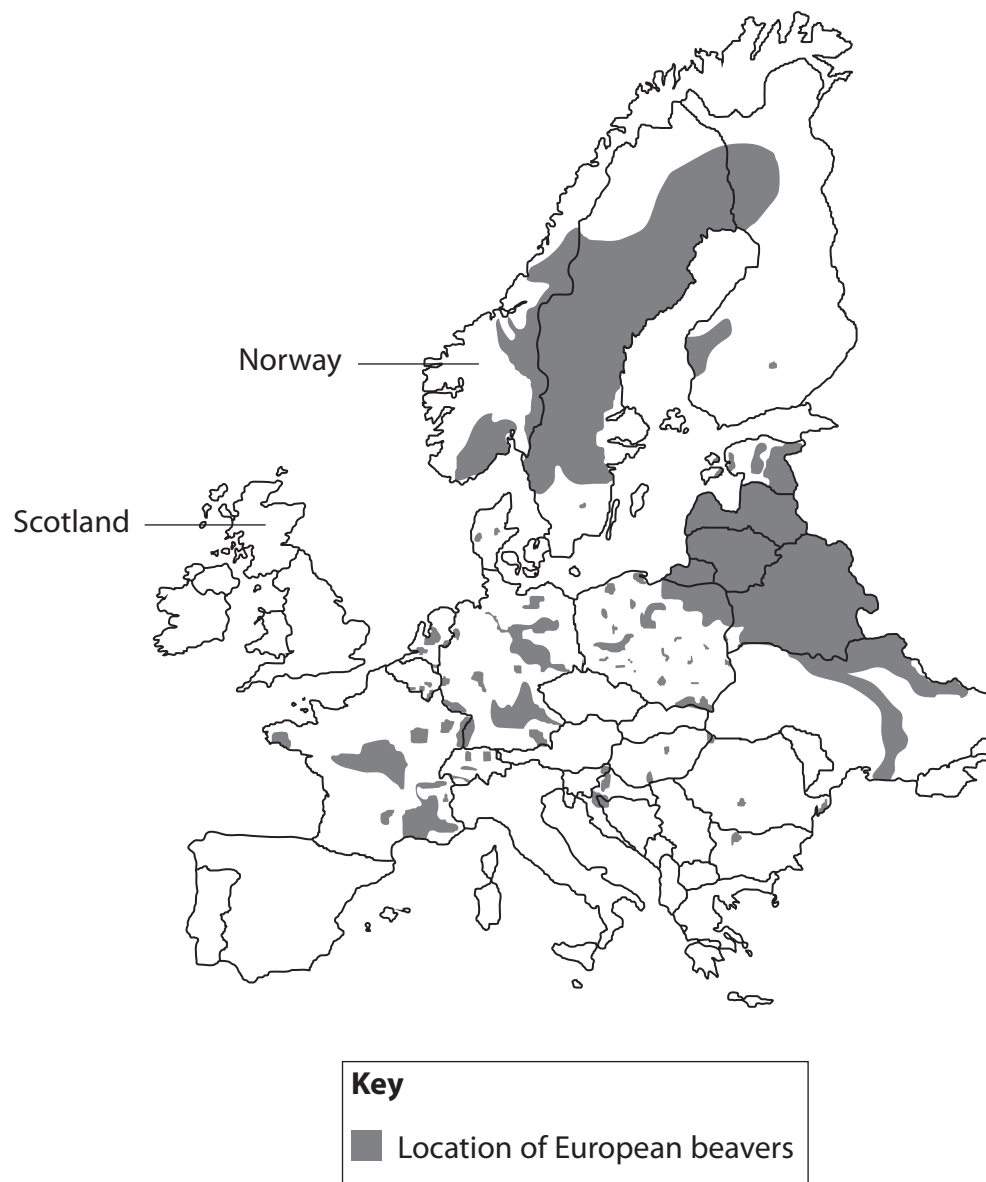
Discuss the solutions, proposed by these scientists, to overcome the concern of introducing only 11 beavers into Scotland from Norway.

Use the information in the map to support your answer.

(6)

P 6 1 4 7 0 A 0 2 8 3 2

(c) In a beaver population, the frequency of a recessive homozygous genotype is 0.09.

Calculate the percentage of beavers in this population that are homozygous for the dominant allele, using the equation

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

(3)

Answer ....%

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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