Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper reference **WBI12/01**

Biology

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

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.
- 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 on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

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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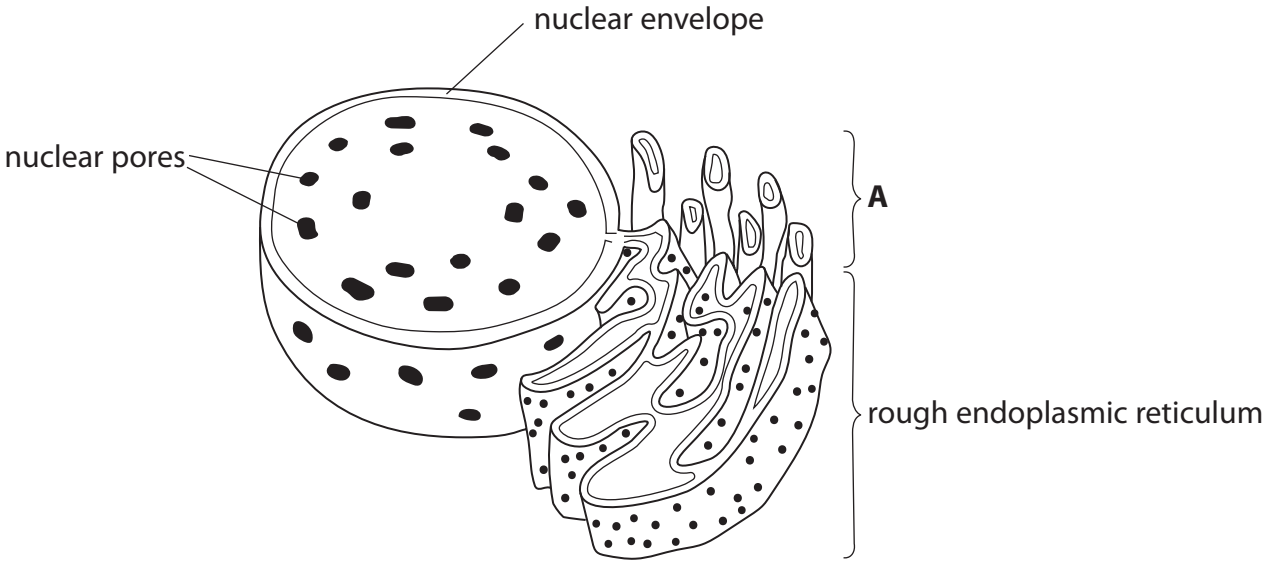
Answer ALL questions.

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 Eukaryotic cells contain cell organelles.

(a) The diagram shows part of a eukaryotic cell, as drawn by a student.
The nuclear envelope, nuclear pores and rough endoplasmic reticulum are labelled.



(i) Which of the following is a correct statement about rough endoplasmic reticulum?

(1)

☒ **A** it has 70S (small) ribosomes

☒ **B** it has 80S (large) ribosomes

☒ **C** it forms vesicles surrounding phospholipids only

☒ **D** it forms vesicles surrounding polysaccharides only

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(ii) Name a substance synthesised by the organelle labelled **A** in the diagram.

(1)

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(iii) Name **two** structures that could be present inside the nucleus in the diagram.

(2)

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2 .....

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(b) After cell division, the plant cells produced increase in size.
Explain how these plant cells increase in size.

(3)

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(Total for Question 1 = 7 marks)

2 The common wombat is endemic to Australia and Tasmania.

The photograph shows a common wombat.



(Source: © Albert Ziraj / Alamy Stock Photo)

magnification × 0.1

(a) Common wombats mark areas of their habitat to signal to other wombats of the same species that they are living there. These marked areas are called territories.

Common wombats produce cube-shaped faeces. It is thought that these cubes can be stacked to mark territory without rolling away.

(i) Calculate the surface area : volume ratio of one cube with a length of 2.5 cm.

(2)

Answer .....

(ii) State what is meant by the term **habitat**.

(1)

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(iii) State what is meant by the term **species**.

(1)

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(b) The height of a wombat is a result of polygenic inheritance.

State what is meant by the term **polygenic inheritance** with reference to wombat height.

(1)

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(c) Common wombats dig burrows to live in. They have adaptations to help them to do this successfully.

Describe **two** anatomical adaptations of a common wombat that help it to dig burrows to live in.

Use the information in the photograph to support your answer.

(2)

1 .....

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(Total for Question 2 = 7 marks)

3 Organisms can be classified using the three-domain system.

Molecular evidence is used to place an organism into one of the three domains.

(a) (i) Give **one** example of the molecular evidence used to support the three-domain system.

(1)

(ii) Describe the role of the scientific community in evaluating the evidence for this system of classification.

(2)

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(b) The table shows some features of living organisms.

Which box in each row shows whether the feature is found in these domains?

(4)

Feature	Archaea only	Archaea and Bacteria only	Archaea and Eukarya only	Archaea and Bacteria and Eukarya
absence of a nuclear envelope	☒	☒	☒	☒
presence of circular DNA	☒	☒	☒	☒
presence of a cell membrane	☒	☒	☒	☒
presence of ribosomes	☒	☒	☒	☒

(Total for Question 3 = 7 marks)

4 A coral reef is an underwater ecosystem.

The photograph shows a coral reef in the Caribbean.



(Source: © Belize / Alamy Stock Photo)

A photosynthetic bacterium found on these coral reefs produces a chemical called curacin A.

This chemical has been found to be effective against some colon and kidney cancers.

(a) Large quantities of this organism need to be grown in a culture medium in order to extract enough curacin A.

The culture is kept at the optimum temperature for the growth of this bacterium.

Suggest **two** other conditions that would be needed for maximum growth of this bacterium.

(2)

1 .....

2 .....

(b) Scientists conduct experiments to determine the effectiveness and safety of new drugs.

(i) Which of the following scientists tested the effectiveness of digitalis soup?

(1)

☒ **A** Adolf Fick

☒ **B** Matthew Meselson and Franklin Stahl

☒ **C** Godfrey Hardy and Wilhelm Weinberg

☒ **D** William Withering

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(ii) Curacin A is being developed as a drug to treat some colon and kidney cancers in humans.

Suggest how a suitable dose for cancer treatment would be determined in human trials.

(2)

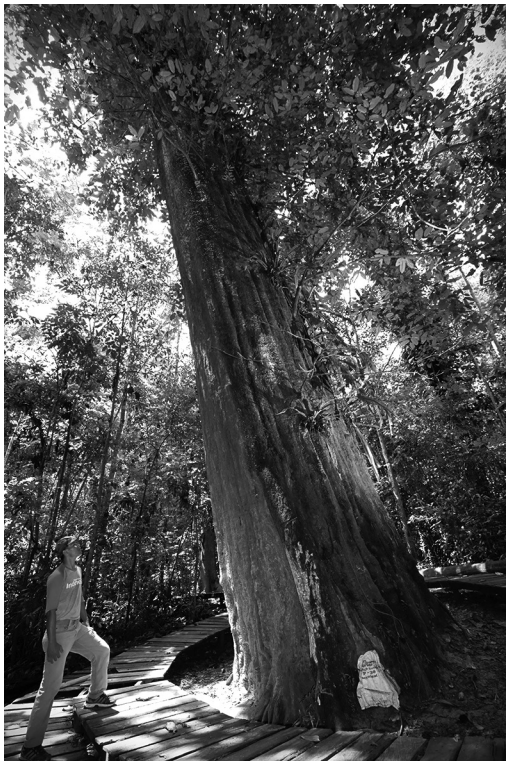
(iii) Describe how a double-blind clinical trial would be performed with this cancer drug.

(4)

(Total for Question 4 = 9 marks)

5 The Ulin tree (*Eusideroxylon zwageri*), is native to Brunei, Indonesia and the Philippines.

The photograph shows an Ulin tree.



(Source: © Pacific Imagica / Alamy Stock Photo)

(a) This species of tree is endangered and the export of wood from these trees is forbidden from some countries.

Suggest **three** reasons why this species of tree is endangered.

(3)

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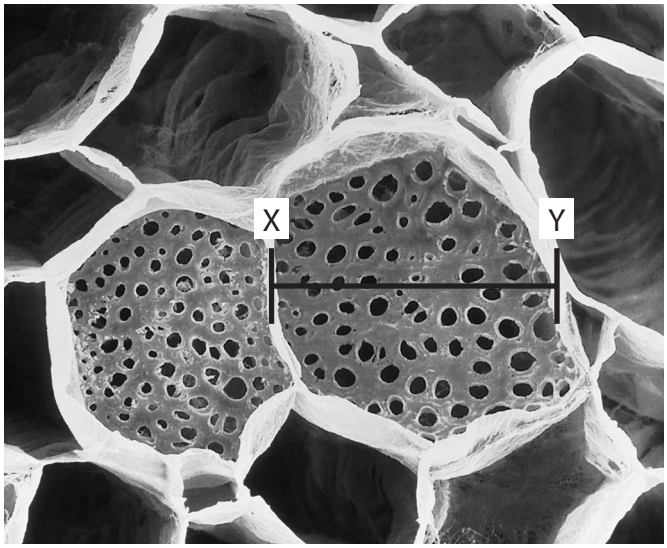
(b) Trees, and other plants, contain phloem vessels and sclerenchyma fibres.

The photograph shows sieve plates in the phloem of a plant.



(Source: © Science Photo Library / Alamy Stock Photo)

magnification × 200

(i) Calculate the width of the phloem vessel along the line XY in micrometres.

Give your answer in standard form.

(3)

Answer ..... µm

(ii) Describe the role of phloem.

(2)

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(iii) How many of the following statements about mature sclerenchyma fibres are correct?

- they contain cellulose microfibrils
- they contain pits
- they contain cytoplasm

(1)

☒ **A** none

☒ **B** one

☒ **C** two

☒ **D** three

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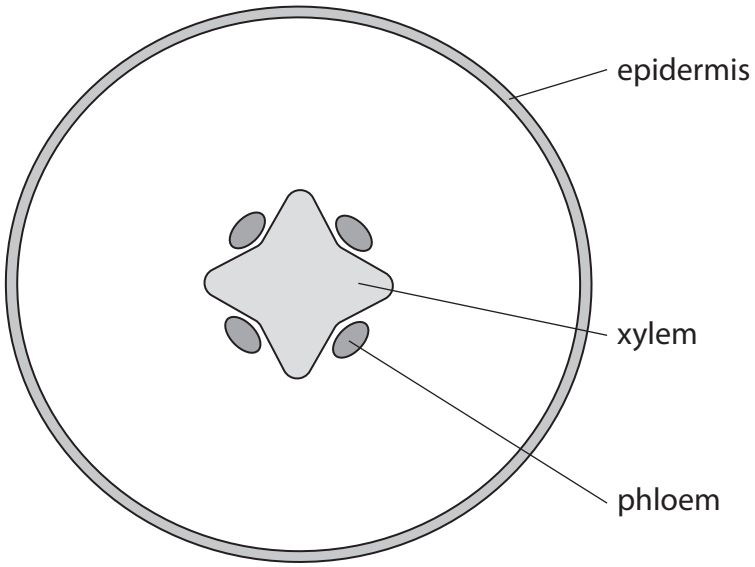
(c) The roots of plants contain phloem and xylem vessels, as shown in the diagram.



Give **three** differences between the distribution of phloem and xylem in the root compared with their distribution in the stem.

(3)

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(Total for Question 5 = 12 marks)

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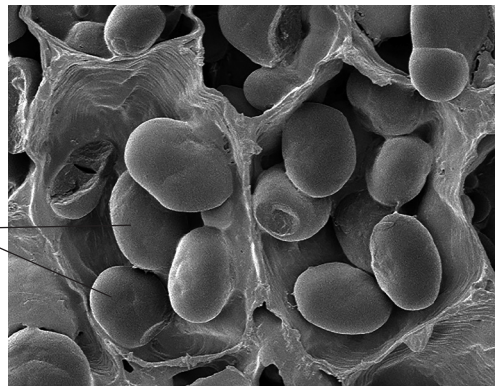
6 The cassava root is an important food crop grown in the tropics.

The photograph shows organelles containing starch granules inside cassava root cells, as seen using an electron microscope.



(Source: © Science Photo Library / Alamy Stock Photo)

(a) (i) Name these organelles found in cassava root cells.

(1)

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(ii) Explain how the structure of starch relates to its function.

(3)

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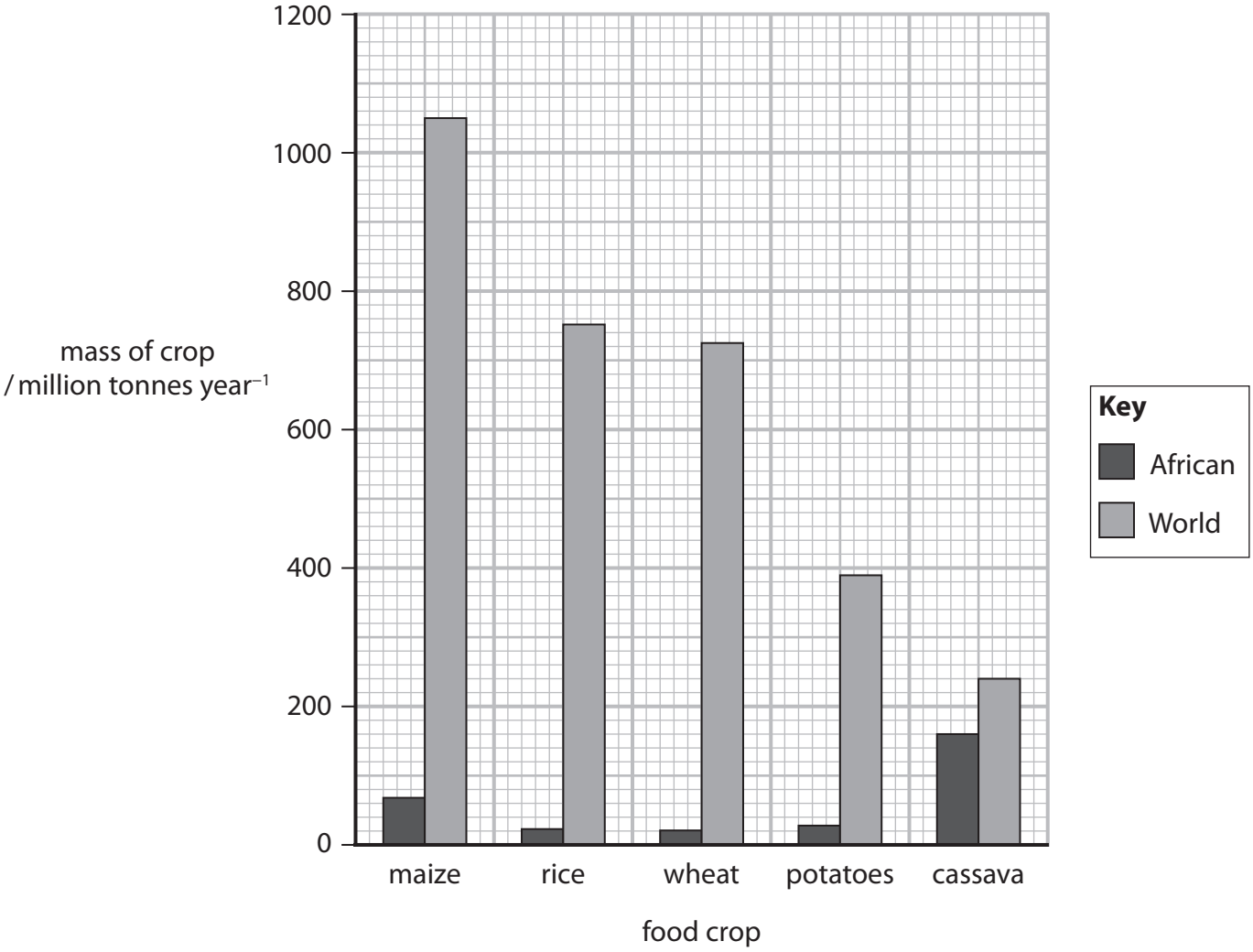
(b) The graph shows the mass of five food crops grown in Africa. It also shows the world production of these crops.



(i) Which is the percentage of the world cassava crop that is grown in Africa?

(1)

- ☒ **A** 33%
- ☒ **B** 34%
- ☒ **C** 66%
- ☒ **D** 67%

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(ii) It is predicted that the world maize production will increase by 2.3 % in the following year.

Calculate the world production of maize in the following year.

Give your answer to the nearest whole number.

(1)

Answer ..... million tonnes

*(c) Some plants contain chemicals that protect them from being eaten by animals.

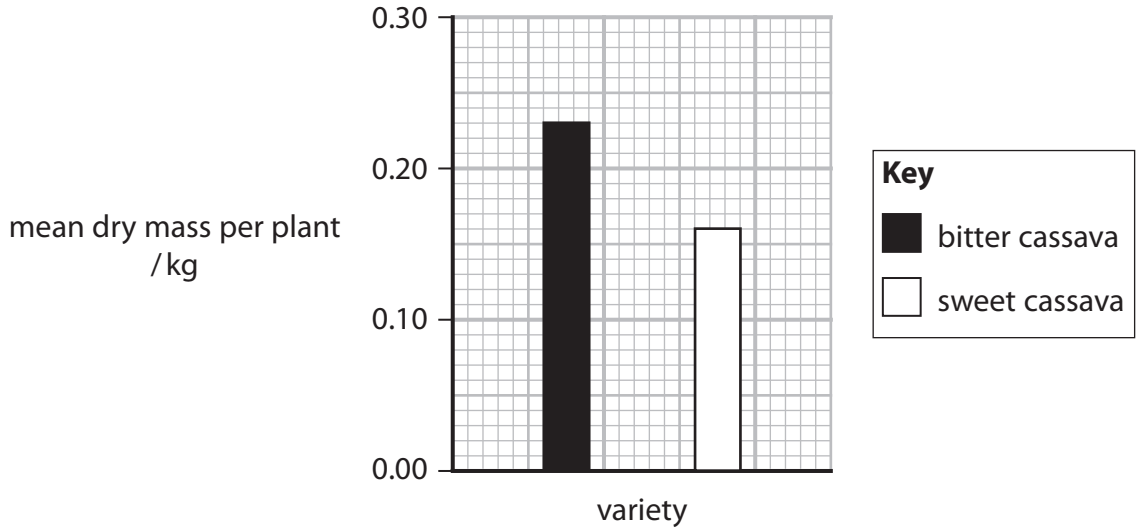
These chemicals taste bitter and can be converted by enzymes into hydrogen cyanide.

Hydrogen cyanide inhibits respiration and can cause death.

Cassava can be grouped into two main varieties: bitter cassava and sweet cassava. These varieties differ in the concentration of the bitter-tasting chemicals.

Processing of the cassava removes most of these chemicals.

The graph shows the mean dry mass of these cassava varieties when grown in the same conditions.



The table gives information about three crop plants.

Crop plant	Water requirements	Minimum level of nutrients required in soil	Typical mass of bitter tasting chemicals / mg kg^{-1}	Typical mass of carbohydrate / 100 g of dry plant matter	Typical mass of protein / 100 g of dry plant matter
Bitter cassava	low to medium	low	100 to 500	94.70	1.80
Sweet cassava	low to medium	low	10 to 50	94.62	1.84
Maize	medium to high	medium to high	1 to 2	77.46	8.75

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Discuss the advantages and disadvantages of growing these three crop plants for human food.

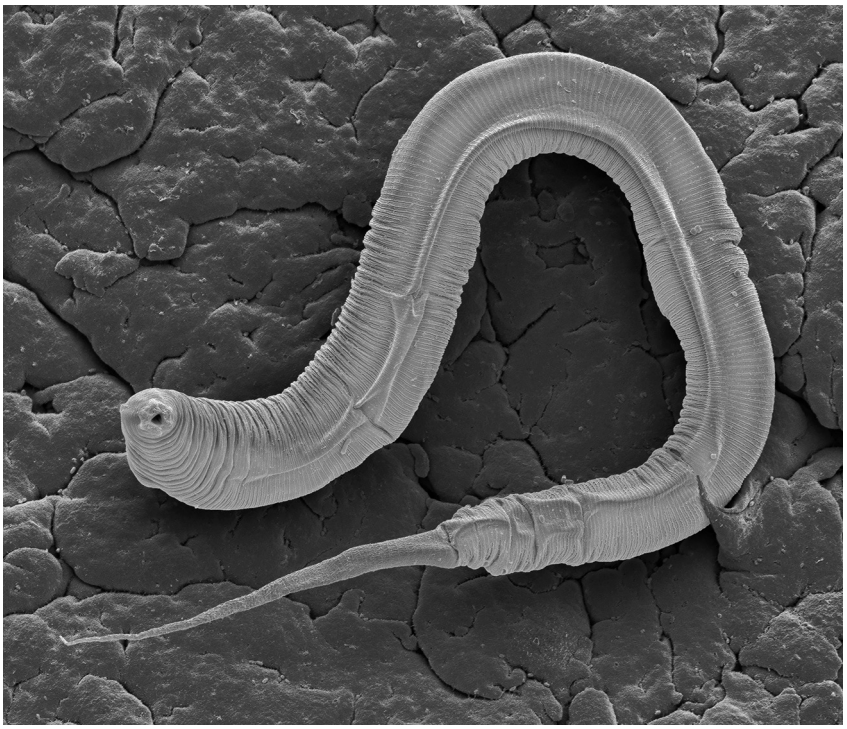
Use the information in the question to support your answer.

(6)

(Total for Question 6 = 12 marks)

7 Variation between organisms occurs as a result of sexual reproduction and epigenetic modification.

The photograph shows a nematode, as seen using an electron microscope.



(Source: © Leonid Serebrennikov / Alamy Stock Photo)

*(a) Animals of this species are either male or hermaphrodites.

Nematodes that inherit one sex chromosome are male.

Nematodes that inherit two sex chromosomes are hermaphrodites.

Hermaphrodites can produce both egg cells and sperm. Approximately 300 sperm are produced first and stored inside the nematode. After this, egg cells are produced.

The sperm of a hermaphrodite nematode can fertilise its own egg cells. This is called self-fertilisation.

However, when a hermaphrodite nematode mates with a male nematode, the sperm of the male fertilises the egg cells. This results in 700 more egg cells being fertilised than when a hermaphrodite self-fertilises. Half of these fertilised egg cells will result in male offspring.

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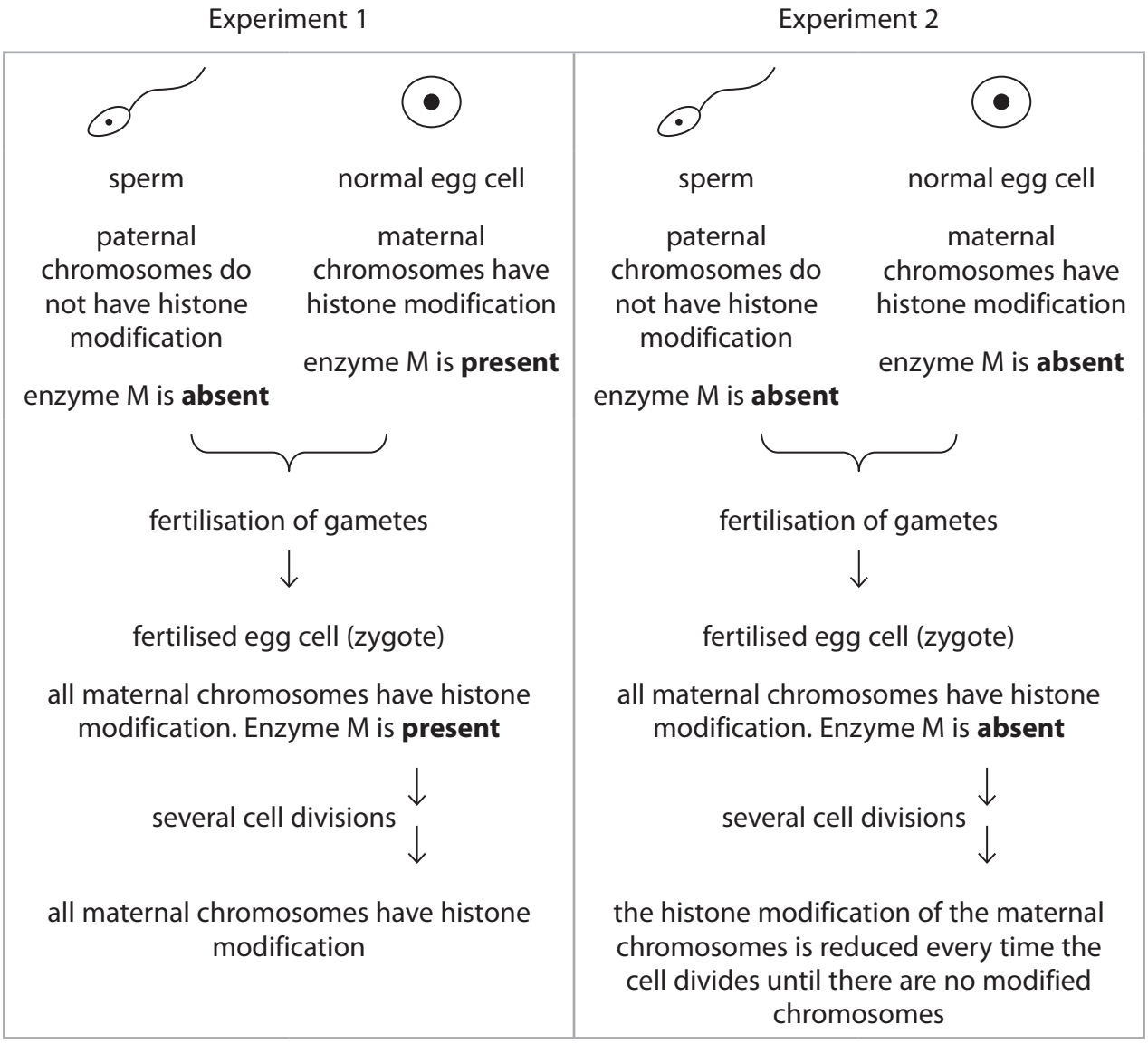
Explain how the reproductive behaviour of these nematodes increases their chance of survival.

(6)

(b) In nematodes, histone modification can be passed onto embryos.
Enzyme M causes this modification.
The diagram shows two experiments that demonstrated this.



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Deduce how histone modification can be passed onto embryos.

(5)

(Total for Question 7 = 11 marks)

8 Egg cells are produced by many organisms.
The development of fish embryos can be studied using fertilised egg cells.
The photograph shows part of a beluga fish from the Caspian Sea.



(Source: © Design Pics / Alamy Stock Photo)

(a) Explain how an egg cell is specialised for its function.

(2)

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(b) A student studied beluga fish cells undergoing mitosis and meiosis.

(i) Compare and contrast metaphase in mitosis and meiosis.

(3)

(ii) Some of the cells undergoing mitosis were from a beluga morula whereas some of the cells were from a beluga blastocyst.

Explain how the cells of the beluga morula change as they develop into the cells of the blastocyst.

(4)

(c) Chickens produce eggs.
The effect of the age of a chicken on the mass of the eggs it laid was investigated.

A statistical test can be used to see if there is a significant correlation between the age of a chicken and the mass of her eggs.

The value generated by this statistical test will always be between −1.0 to +1.0.

The table shows the mass of eggs collected from chickens of different ages.

Age / weeks	Rank of age	Mass of egg / g	Rank of mass of egg	D	D^2
36	1	2.27	8	−7	49
39	2	1.91			
42	3	2.18	5.5	−2.5	6.25
45	4	2.28	9	−5	25
48	5	2.12	4	1	1
51	6	2.19	7	−1	1
54	7	2.18	5.5	1.5	2.25
57	8	2.09	3	5	25
60	9	2.03	2		

(i) Calculate the value for $\sum D^2$.
Use the table to help you.

(2)

$\sum D^2 =$ .....

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(ii) Calculate the correlation coefficient, r_s value, for this data using the formula:

(2)

$$r_s = 1 - \frac{6\left(\sum D^2\right)}{n\left(n^2 - 1\right)}$$

Answer .....

(iii) The null hypothesis is that there was no significant correlation between the age of the chicken and the mass of the eggs laid.
Another scientist replicated this study and gained a correlation coefficient value of 0.38.
The table shows the critical values at the 95% probability level.

Number of pairs of data	Critical values at the 0.05 % probability level
8	0.738
9	0.683
10	0.648

Explain whether the null hypothesis should be accepted or rejected.

(2)

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(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS

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