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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 19 May 2020

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 **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 2 4 5 9 A 0 1 2 8

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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 Plants contain starch and cellulose.

(a) (i) Which part of a plant cell stores starch?

(1)

☒ **A** amyloplast

☒ **B** middle lamella

☒ **C** plasmodesmata

☒ **D** tonoplast

(ii) How many of the following statements about starch are correct?

1. it has a compact shape
2. it contains 1,6 glycosidic bonds only
3. it is a polymer of β-glucose
4. it is a polypeptide

(1)

☒ **A** one

☒ **B** two

☒ **C** three

☒ **D** four

(iii) How many of the following contain cellulose?

1. phloem
2. sclerenchyma
3. vacuole
4. xylem

(1)

☒ **A** one

☒ **B** two

☒ **C** three

☒ **D** four

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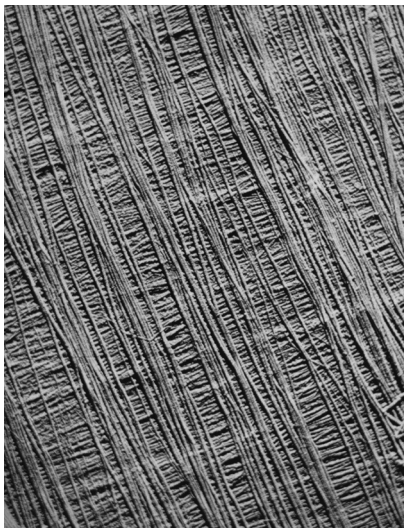
(b) Microfibrils are composed of cellulose.

The photograph shows the arrangement of microfibrils in a plant cell wall, as seen using an electron microscope.



(Source: © Biophoto associates/Science photo library)

Explain how the structures of cellulose and microfibrils increase the strength of a plant cell wall.

Use the information in the photograph to support your answer.

(3)

(Total for Question 1 = 6 marks)

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2 All organisms contain one or more cells.

(a) (i) In which of the following is a cell membrane present?

(1)

- ☒ **A** animal cells only
- ☒ **B** animal and plant cells only
- ☒ **C** plant and prokaryotic cells only
- ☒ **D** animal, plant and prokaryotic cells

(ii) In which of the following is a cell wall present?

(1)

- ☒ **A** plant cells only
- ☒ **B** animal and plant cells only
- ☒ **C** plant and prokaryotic cells only
- ☒ **D** animal, plant and prokaryotic cells

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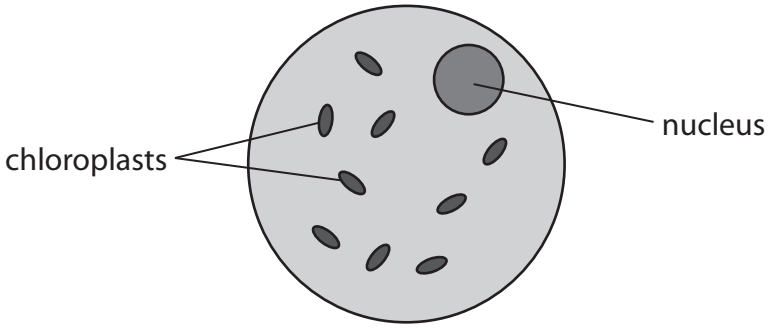
(b) Sailor's eyeball (*Valonia ventricosa*) is a single-celled, spherical organism.

The diagram shows one of these cells.



(i) The diameter of this cell is 25 μm.

Calculate the magnification of the diagram.

(2)

Answer .....

(ii) This cell contains chloroplasts.

State the function of these chloroplasts.

(1)

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(iii) This cell is not a prokaryotic cell as it contains chloroplasts.

Give **one** other reason why this organism is not a prokaryotic cell.

(1)

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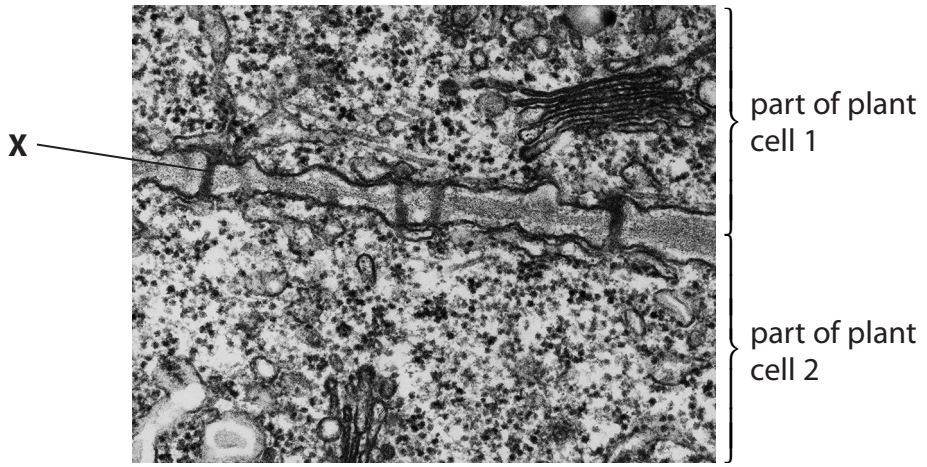
(c) The photograph shows part of two adjoining plant cells, as seen using an electron microscope.



(Source: © biophoto associates/Getty Images)

(i) Name the part labelled **X**.

(1)

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(ii) Explain the function of the part labelled **X**.

(2)

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(Total for Question 2 = 9 marks)

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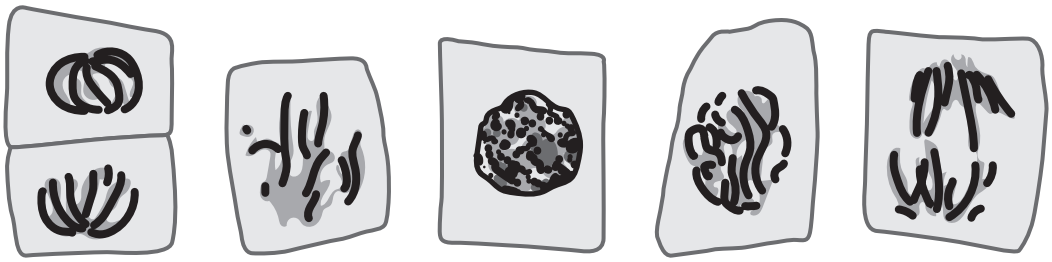
3 Cells undergo cell division.

(a) The diagrams show cells from a plant.

The cells are in different stages of division.

These cells do not show the correct order for the process of division by mitosis.



A **B** **C** **D** **E**

Which of the following shows the correct order for the process of division by mitosis?

(1)

	1st	2nd	3rd	4th	5th
☒ **A**	A	E	B	D	C
☒ **B**	A	D	C	E	B
☒ **C**	C	D	B	E	A
☒ **D**	C	B	E	D	A

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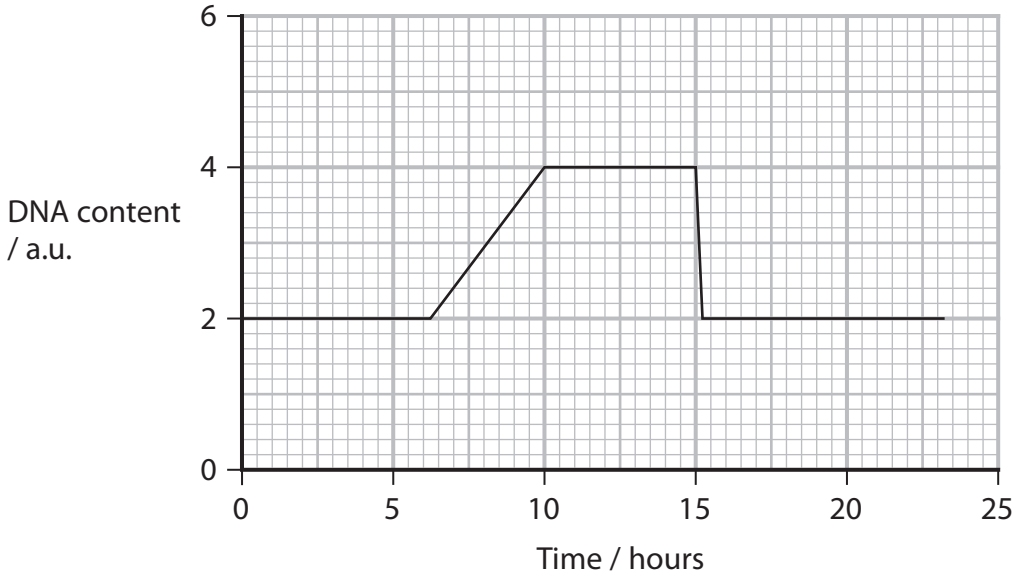
(b) The graph shows the changes in the DNA content of a cell during one cell cycle.



(i) Explain the changes in the DNA content as shown by this graph.

(4)

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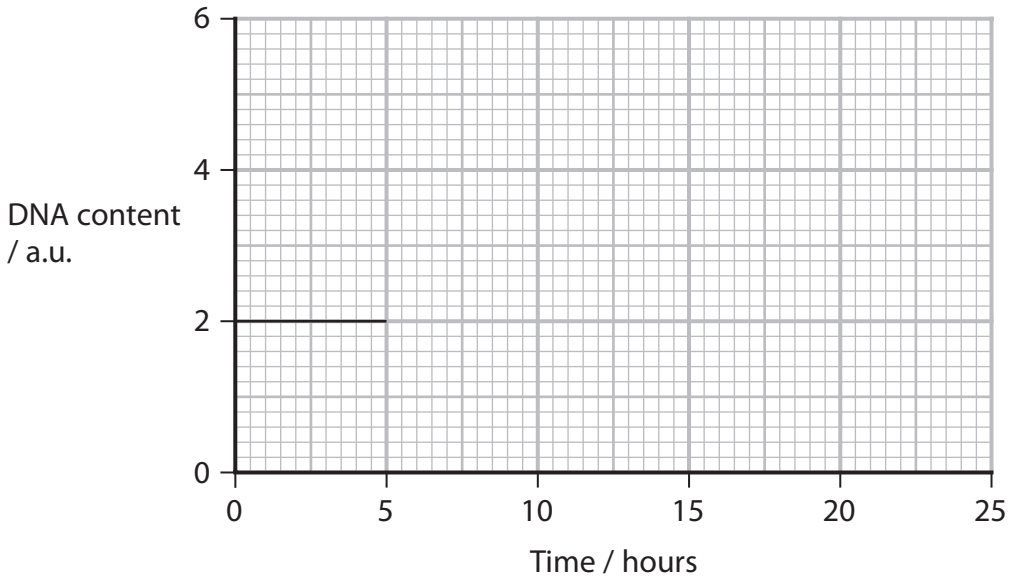
(ii) Complete the graph to show how the DNA content would change if the cell had undergone meiosis to form gametes.

(2)



(Total for Question 3 = 7 marks)

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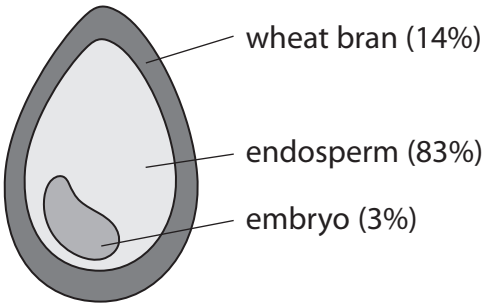
4 Plant-based products can replace plastics produced from oil.

Wheat bran comes from the outer layers of grains of wheat.

(a) The diagram shows the structure and composition of a grain of wheat.



Wheat bran contains 43% fibre.

A grain of wheat has a mass of 48 mg.

Calculate the mass of fibre in the wheat bran of this grain of wheat.

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

(3)

Answer ..... mg

(b) Disposable plates and cutlery can be made from either plant-based products or from oil-based plastics.

The photograph shows cutlery and a plate made from wheat bran.



(Source: © Konektus Photo/Shutterstock)

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Explain the advantages of using cutlery and plates made from wheat bran instead of oil-based plastics.

(3)

(c) The endosperm of a grain of wheat develops from the endosperm nucleus, formed during fertilisation.

Explain the role of the pollen tube and nuclei in the formation of the endosperm nucleus.

(3)

(Total for Question 4 = 9 marks)

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5 The five stages of cancer are used to describe the size and spread of a cancer in a human body.

(a) The mitotic index of a tissue can be used to determine the stage of cancer.

A higher mitotic index is usually linked to a later stage of cancer.

The mitotic index is calculated using the formula

$$\text{Mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$$

Tests were performed on three patients, P, Q and R, who had cancer.

The table shows the number of cells that were counted in each stage of the cell cycle per mm^2 of tissue, taken from the same organ in each patient.

Patient	Interphase	Prophase	Metaphase	Anaphase	Telophase
P	16	1	3	0	0
Q	14	2	1	1	2
R	11	2	2	3	2

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

(1)

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(ii) Using the data in the table, determine the stages of cancer in patients P and R.

(3)

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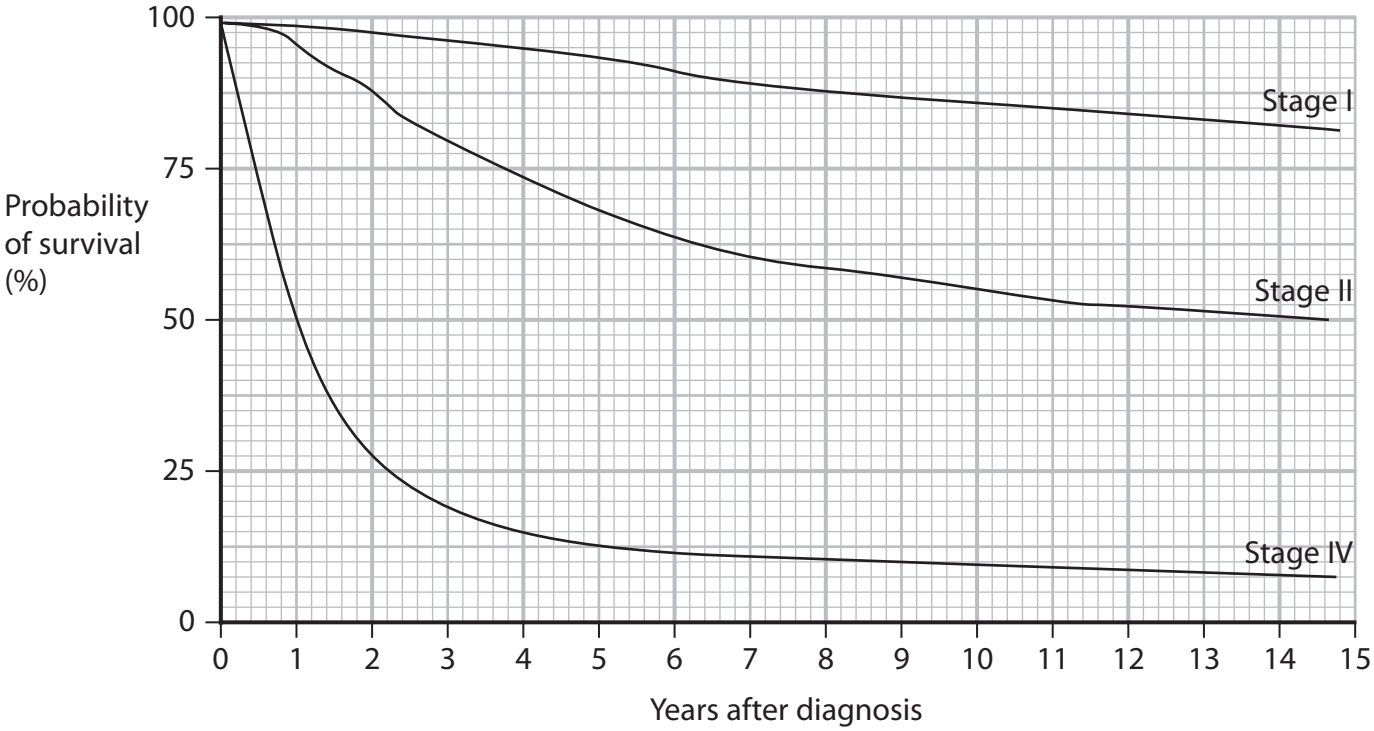
(b) The graph shows the probability of survival for different stages of a cancer, after diagnosis.



(Source: http://www.mmmp.org/MMMP/import.mmmp?page=tnm_staging.mmmp)

Compare and contrast the probabilities of survival for the different stages of this cancer, as shown by the graph.

(3)

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(c) Anticancer drugs have to undergo double-blind trials before they are used to treat patients.

Describe how a placebo is used in a double-blind trial.

(2)

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(Total for Question 5 = 9 marks)

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6 Stomach ulcers are sores that develop in the lining of the stomach.

The mucus produced by the stomach prevents bacteria from reaching the lining of the stomach.

Stomach ulcers can be caused by infection with the bacterium *Helicobacter pylori*.

These bacteria reproduce in the stomach as it provides all the conditions required for the growth of bacteria.

(a) Explain the conditions needed for the growth of bacteria.

(4)

(b) The plant *Cibotium barometz* is native to several countries in East Asia.

The photograph shows hairs on the surface of this plant.



(Source: © Mauro Rodrigues/123RF)

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Extracts from the hairs on this plant have antimicrobial properties.

An investigation compared the use of this extract and the drug omeprazole to treat stomach ulcers in rats.

The mass of mucus and the area of ulcer were measured in five groups of rats.

The table shows the treatments and the results of this investigation.

Group	Treatment / mg kg^{-1}	Mean mass of mucus / g	Mean area of ulcer / mm^2
Control rats with no ulcer	0.00	2.28	0.00
Control rats with ulcer	0.00	0.75	802.71
Rats with ulcer treated with omeprazole	20.00	1.92	95.71
Rats with ulcer treated with extract	125.00	1.87	202.80
Rats with ulcer treated with extract	500.00	2.17	172.80

(Source: adapted from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5244617/)

(i) Calculate the percentage decrease in the mean areas of ulcer of the rats treated with omeprazole compared with the control rats with ulcer.

(2)

Answer ..... %

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*(ii) Explain the results of this investigation.

Use all the information in Question 6 to support your answer.

(6)

(Total for Question 6 = 12 marks)

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7 Meiosis increases genetic variation through independent assortment and crossing over.

(a) (i) In which stage of meiosis does independent assortment occur?

(1)

- ☒ **A** metaphase I
- ☒ **B** metaphase II
- ☒ **C** telophase I
- ☒ **D** telophase II

(ii) In which stage of meiosis does crossing over occur?

(1)

- ☒ **A** metaphase I
- ☒ **B** metaphase II
- ☒ **C** prophase I
- ☒ **D** prophase II

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(b) Genetic variation increases due to the production of new combinations of alleles.

A cell has gene A and gene B with alleles A, a and B, b.

Meiosis could produce the following percentages of gametes containing the combinations of alleles shown in the table.

Combination of alleles	Percentage of total gametes produced (%)
AB	48
Ab	2
aB	2
ab	48

Explain why the percentages are not 25% for each combination of alleles.

(3)

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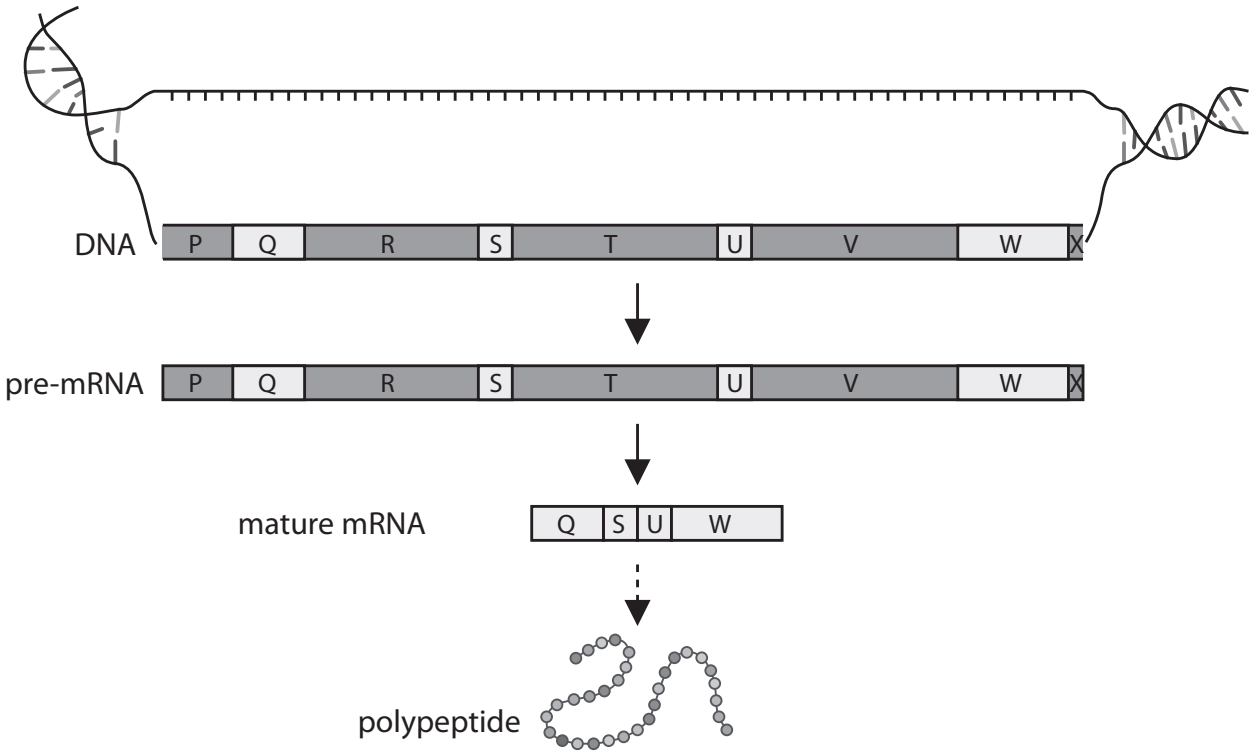
(c) More than one type of protein can be synthesised from the RNA produced from one gene.

The diagram shows parts of this process.



Describe how more than one type of protein can be synthesised from the RNA produced from one gene.

Use the information in the diagram to support your answer.

(5)

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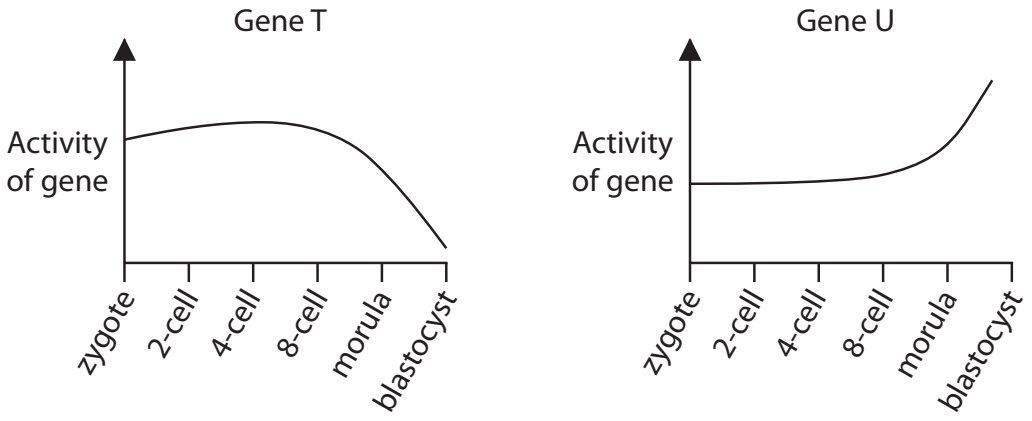
(d) The graphs show the activity of two genes, T and U, as a mouse zygote (fertilised egg cell) develops into a blastocyst.



Comment on the changes in the activity of these two genes.

(3)

(Total for Question 7 = 13 marks)

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8 The photograph shows a Tristan albatross.



(Source: © blickwinkel/Alamy Stock Photo)

The Tristan albatross is endemic to a few small islands in the South Atlantic Ocean.

The adult birds nest on these islands and fly long distances in search of food.
They feed on fish, octopus and squid.

The Tristan albatross is critically endangered, with 4 500 of these birds left in the wild.

(a) (i) Describe **two** anatomical adaptations of the Tristan albatross that enable it to occupy its niche.

Use the information in the photograph to support your answer.

(2)

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(ii) It has been predicted that the population will continue to decline by 5.3% per year.

Calculate the predicted albatross population after one year.

(2)

Answer .....

(b) The Tristan albatross (*Diomedea dabbenena*) was once classified as the same species as the wandering albatross (*Diomedea exulans*).

The photograph shows a wandering albatross.



(Source: © Rebecca Jackrel/Alamy Stock Photo)

Suggest why the Tristan albatross and wandering albatross were once classified as the same species.

(1)

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(c) Tristan albatross chicks in nests on one island have been found to be at risk of predation from mice.

The diagram shows an albatross chick and two mice on this island.



Over a long period of time, mice on this island have become 50% larger than normal mice.

It has been suggested that the mice from this island are a new species.

Suggest how the mice on this island have evolved to become a new species.

(4)

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*(d) Scientists have suggested that the Tristan albatross could be conserved.

Some suggestions are conservation strategies on the island where the mice are found.

Some suggestions involve zoos in other countries.

Explain how the Tristan albatross could be conserved.

Use the information in Question 8 to support your answer.

(6)

(Total for Question 8 = 15 marks)

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