



General Certificate of Secondary Education  
2019

Centre Number

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Candidate Number

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# Double Award Science Biology

Unit B2  
Higher Tier

<b>MV18</b>
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[GDW42]

**FRIDAY 7 JUNE, MORNING**

## Time

1 hour 15 minutes, plus your additional time allowance.

## Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

**You must answer the questions in the spaces provided.**

**Do not write on blank pages.**

Complete in black ink only.

Answer **all nine** questions.

## Information for Candidates

The total mark for this paper is 80.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question 4.

- 1 (a) The table shows the predicted and actual percentage of women who experienced **unexpected** pregnancies in a year when different contraceptive methods were used.

Contraceptive method	Percentage of women who experienced unexpected pregnancies in a year	
	predicted	actual
Male condom	2	18
Contraceptive pill	0.3	9
Contraceptive implant	0.05	0.05
Male sterilisation	0.10	0.15

- (i) Which contraceptive method, shown in the table, is the most reliable? [1 mark]

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- (ii) Suggest **one** reason for the difference in the predicted and actual percentage of unexpected pregnancies when the contraceptive pill is used. [1 mark]

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(b) Explain how a contraceptive implant works. [2 marks]

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(c) One disadvantage of male sterilisation is that it does not prevent the transmission of a sexually transmitted infection.

(i) Explain why. [1 mark]

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(ii) Give **one** other disadvantage of male sterilisation. [1 mark]

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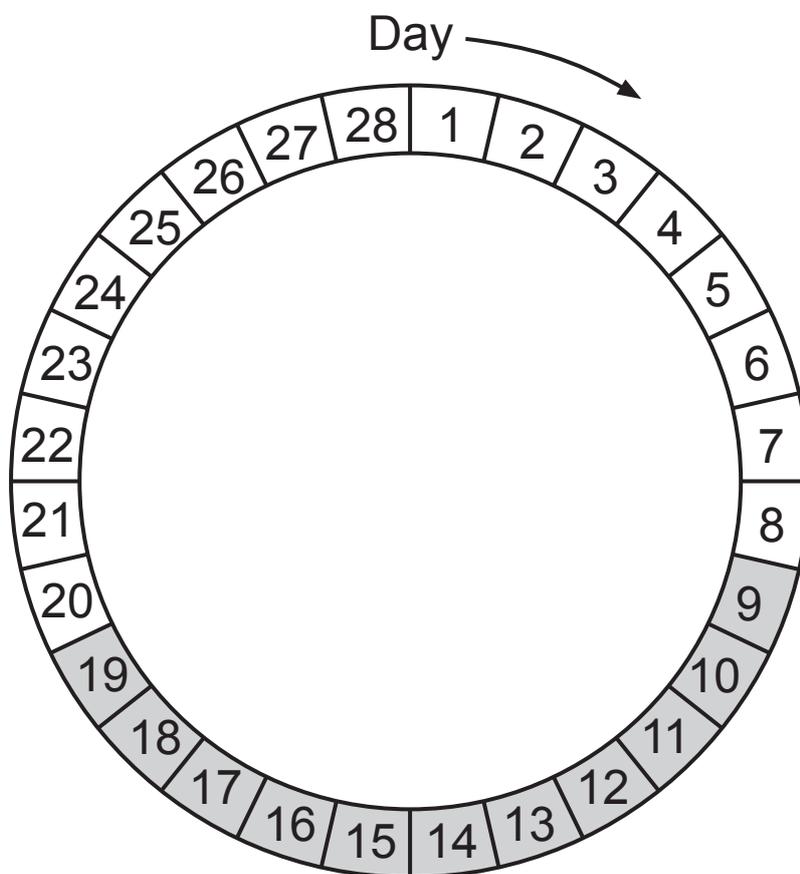
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Some people object to using artificial contraception.

These people do not use artificial contraception but may abstain from sexual intercourse from day 9 to 19 of the woman's menstrual cycle.

Sperm can survive for up to five days inside a woman's body.

The diagram shows a woman's 28-day menstrual cycle.



**(d)** Suggest why abstaining from sexual intercourse from day 9 to 19 of this woman's menstrual cycle could avoid pregnancy. [3 marks]

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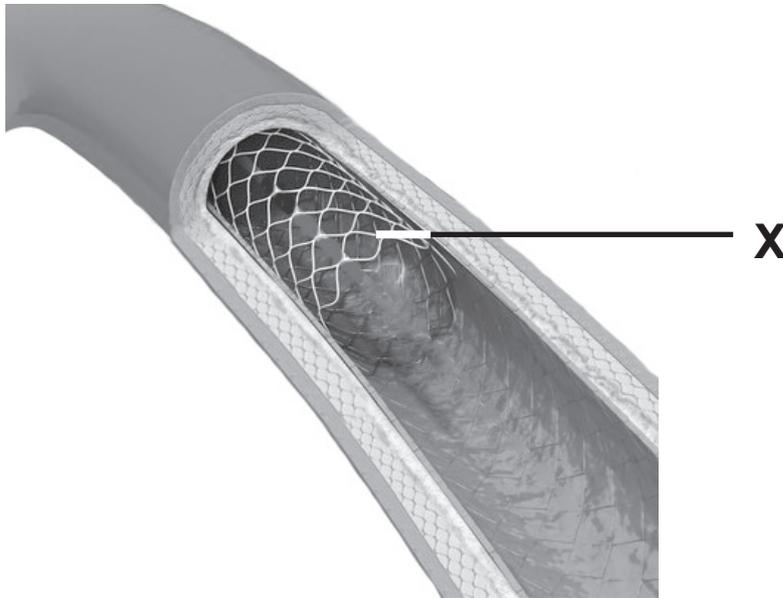
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- 2 (a) Angioplasty is a medical procedure carried out in an artery.

The diagram shows the end result of this procedure.



- (i) Why is angioplasty carried out? [1 mark]

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- (ii) Name structure **X** which has been inserted into this artery during angioplasty. [1 mark]

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**(b)** Drugs such as statins and aspirin can help prevent cardiovascular disease.

**(i)** How does treatment with statins help prevent cardiovascular disease? [2 marks]

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**(ii)** How does treatment with aspirin help prevent cardiovascular disease? [2 marks]

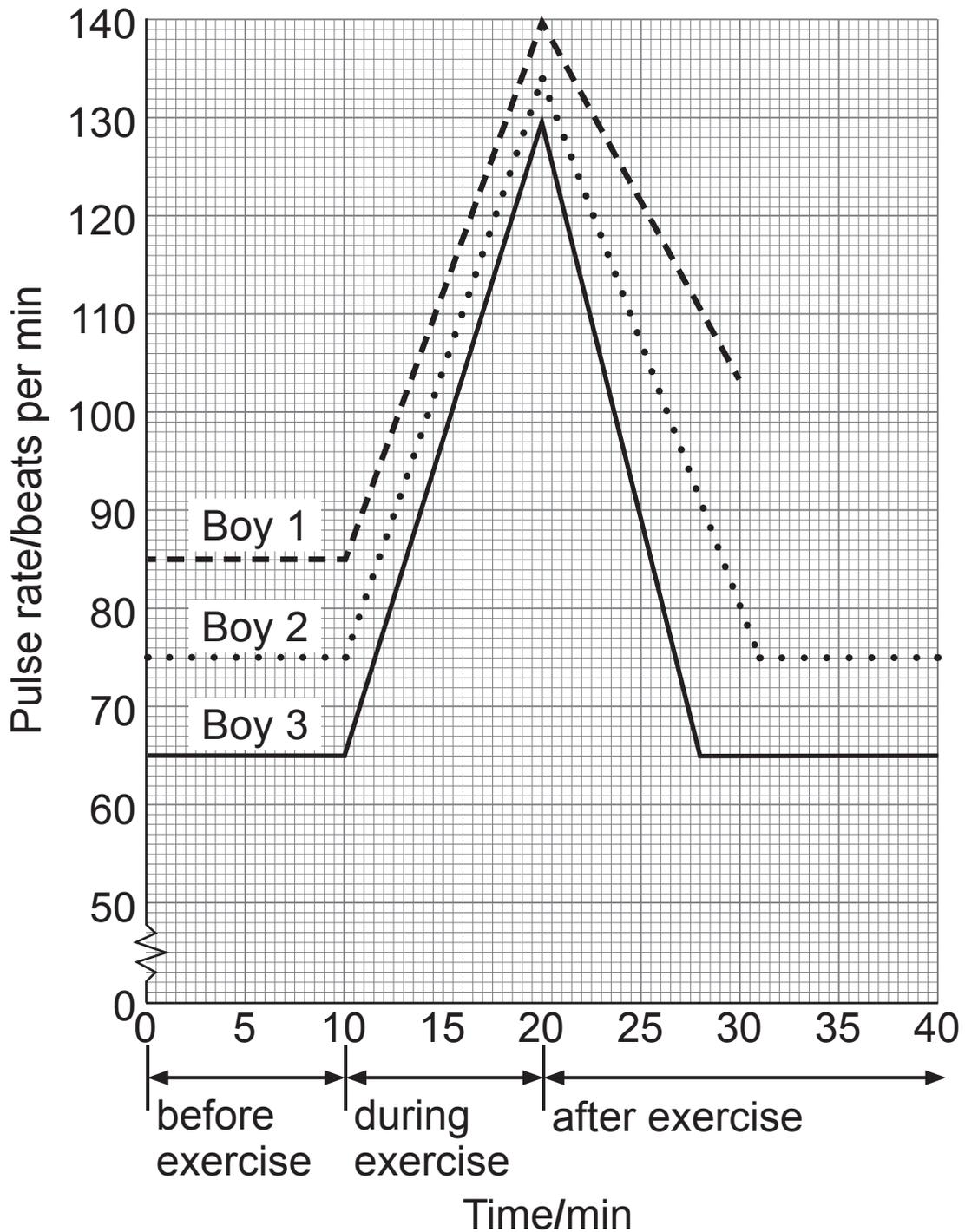
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- 3 (a) The graph shows the pulse rates of three boys before exercise, during exercise and after exercise.



- (i) On the graph opposite, continue the line for Boy 1 after exercise to find the time his pulse rate returned to its value before exercise. [1 mark]
  
- (ii) Give the time when Boy 1's pulse rate returned to its value before exercise. [1 mark]

\_\_\_\_\_ min

(b) Boy 3 is the fittest.

Use the graph opposite to support this statement.  
[3 marks]

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(c) Give **two** advantages to the heart of regular exercise.  
[2 marks]

1. \_\_\_\_\_

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2. \_\_\_\_\_

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The information in the box gives an example of how one infected person can result in a large number of infected people in a population, after three years.

One infected person infects 10 other people during year 1.  
Each newly infected person from year 1 infects 10 other people during year 2.  
Each newly infected person from year 2 infects 10 other people during year 3.

**(b)** Calculate the **total number** of people with TB in this population after three years. [3 marks]

**Show your working.**

\_\_\_\_\_

**(c) (i)** Name the **type** of chemical used to treat bacterial diseases such as TB. [1 mark]

\_\_\_\_\_

**(ii)** Name the **type** of organism that produces this type of chemical. [1 mark]

\_\_\_\_\_

In 2016, there were 10.4 million new cases of TB worldwide.

In 600,000 of these cases, the bacteria were resistant to the type of chemical used to treat TB.

**(iii)** Calculate the percentage (%) of the new cases of TB where the bacteria were resistant.

Give your answer to **two** decimal places. [2 marks]

**Show your working.**

\_\_\_\_\_ %

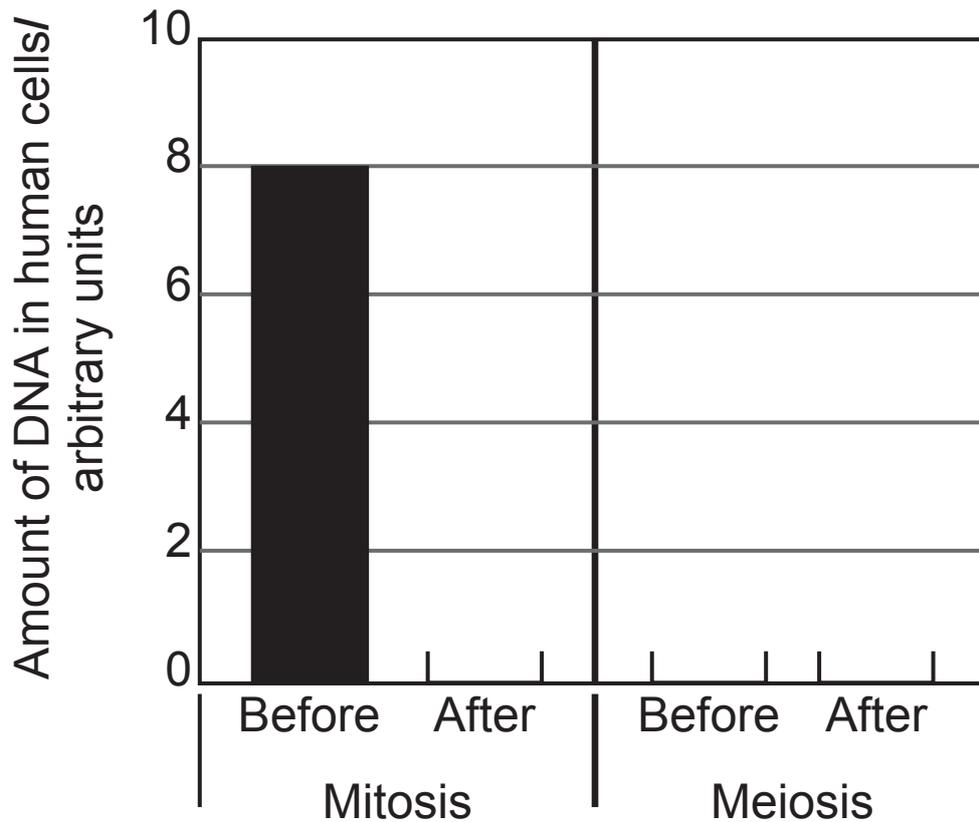
**(iv)** Suggest why bacterial resistance has increased over the past 20 years. [1 mark]

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**(Questions continue overleaf)**

- 6 The bar chart shows the amount of DNA in human cells before mitosis.



- (a) Complete the bar chart by drawing **three** shaded bars to show the amount of DNA in **each cell**: [3 marks]

- after mitosis.
- before meiosis.
- after meiosis.

Each of the bars has been started for you.

- (b) What happens to the DNA in a cell at the start of meiosis? [1 mark]
-

(c) Which bar on the bar chart shows the amount of DNA in a haploid cell?

Underline the correct answer in the list below.  
[1 mark]

before mitosis

after mitosis

before meiosis

after meiosis

(d) Name **one type** of human body cell where mitosis occurs. [1 mark]

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(e) Name **one** human organ where meiosis occurs. [1 mark]

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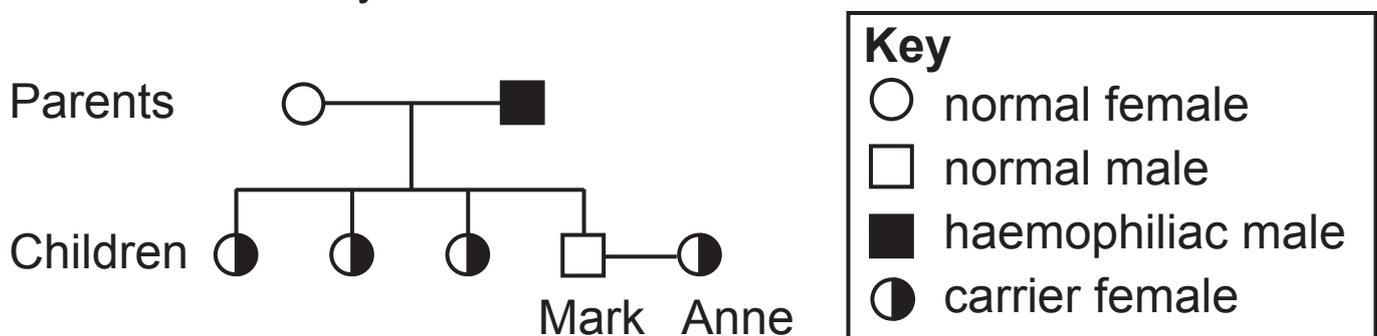
7 (a) Haemophilia is a genetic, sex-linked condition.

An X chromosome with the haemophilia allele is represented as  $X^h$ .

A normal X chromosome without the haemophilia allele is represented as  $X^H$ .

The haemophilia allele is **not** carried on a Y chromosome.

The pedigree diagram shows inheritance of haemophilia in a family.



- (i) Write the genotypes of the parents in the spaces below. [2 marks]

Mother \_\_\_\_\_ Father \_\_\_\_\_

- (ii) Use the genotypes of both parents to explain why the three female children are carriers of haemophilia. [2 marks]

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**(iii)** Use the genotypes of both parents to explain why Mark does not have haemophilia. [2 marks]

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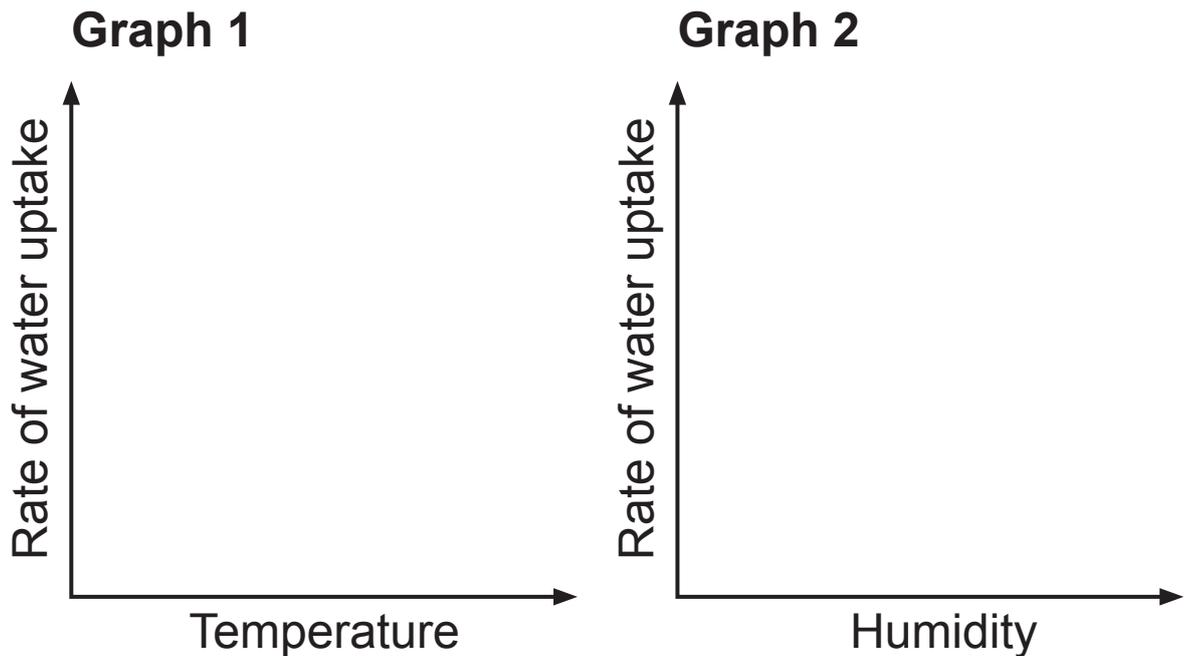
**(b) (i)** Use the information in the pedigree diagram on page 18 to draw a Punnett square showing the possible genotypes of a child born to Mark and Anne. [4 marks]

**(ii)** Use the results from the Punnett square to give the percentage (%) chance that a child born to Mark and Anne would have haemophilia. [1 mark]

\_\_\_\_\_ %

8 (a) The rate of water uptake by plants is affected by various factors.

(i) On each of the graphs below, draw a line to show how increasing temperature and increasing humidity affect the rate of water uptake in plants. [2 marks]



(ii) Describe and explain how increasing light intensity affects the rate of water uptake in plants. [3 marks]

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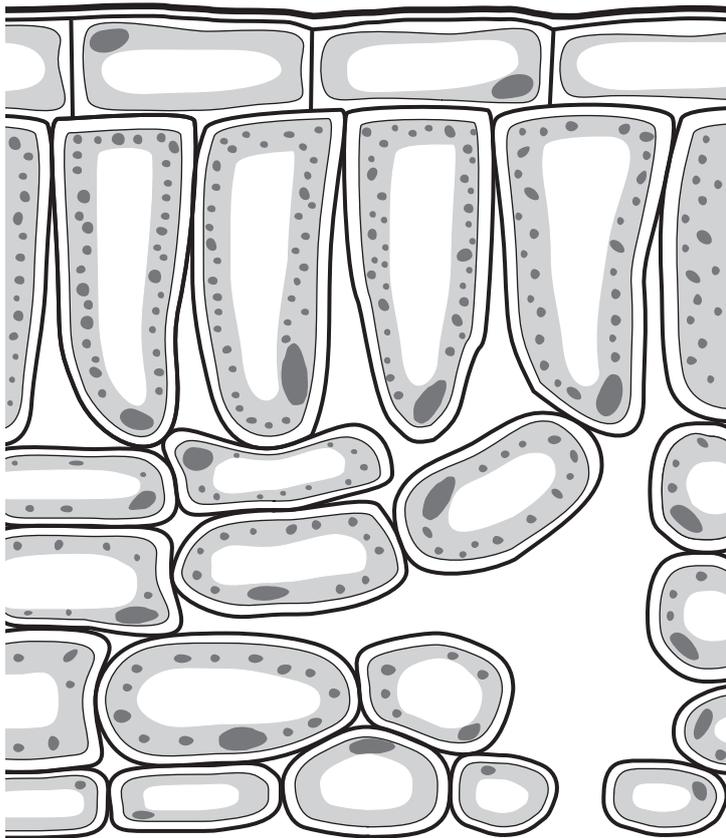
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(b) The diagram shows a cross section through a leaf.



- (i) Draw an arrow on the diagram to show the pathway of water from a spongy mesophyll cell to the air outside the leaf. [2 marks]
- (ii) Suggest **two** adaptations the leaves of some plants have to reduce water loss. [2 marks]

1. \_\_\_\_\_

2. \_\_\_\_\_

- 9 (a) The diagram shows the base pairs in a length of human DNA.

G	A	C	G	C	T	G	C	A	T	C	C	G	T	A
C	T	G	C	G	A	C	G	T	A	G	G	C	A	T

The base A makes up 20% of the bases in this length of human DNA.

- (i) Calculate the percentage (%) of the base **G** in this length of human DNA. [2 marks]

**Show your working.**

\_\_\_\_\_ %

- (ii) How many amino acids would this length of DNA code for? [1 mark]

\_\_\_\_\_

- (b) In genetic engineering, a gene is cut from human DNA using an enzyme.

- (i) Name the **type** of enzyme used to cut out genes from DNA. [1 mark]

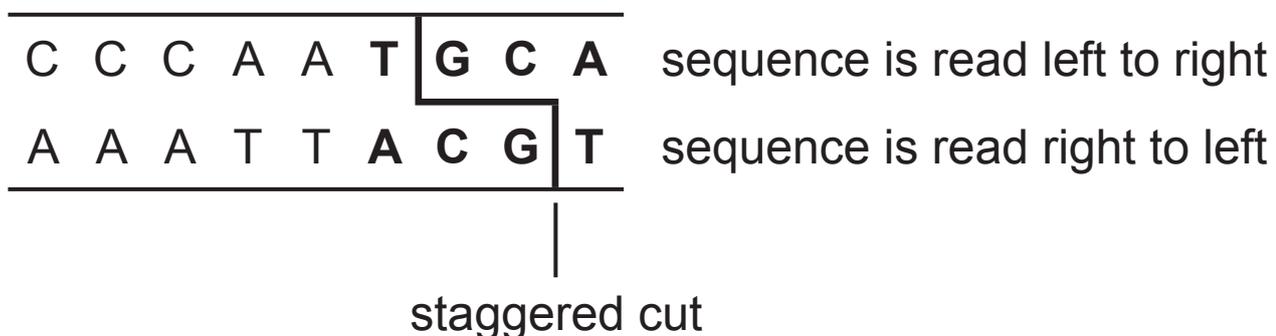
\_\_\_\_\_

One of these enzymes **only** cuts a length of DNA between the bases T and G when they are found in the base **sequence TGCA**.

The base sequence TGCA can be read from left to right or from right to left.

This produces a staggered cut.

The diagram shows a length of DNA that has been cut by this enzyme,



Another length of DNA is shown below.

- (ii) On this length of DNA, mark clearly with a thick black line the staggered cuts produced when this length of DNA is cut with the **same** enzyme.

Use the diagram above to help you. [2 marks]

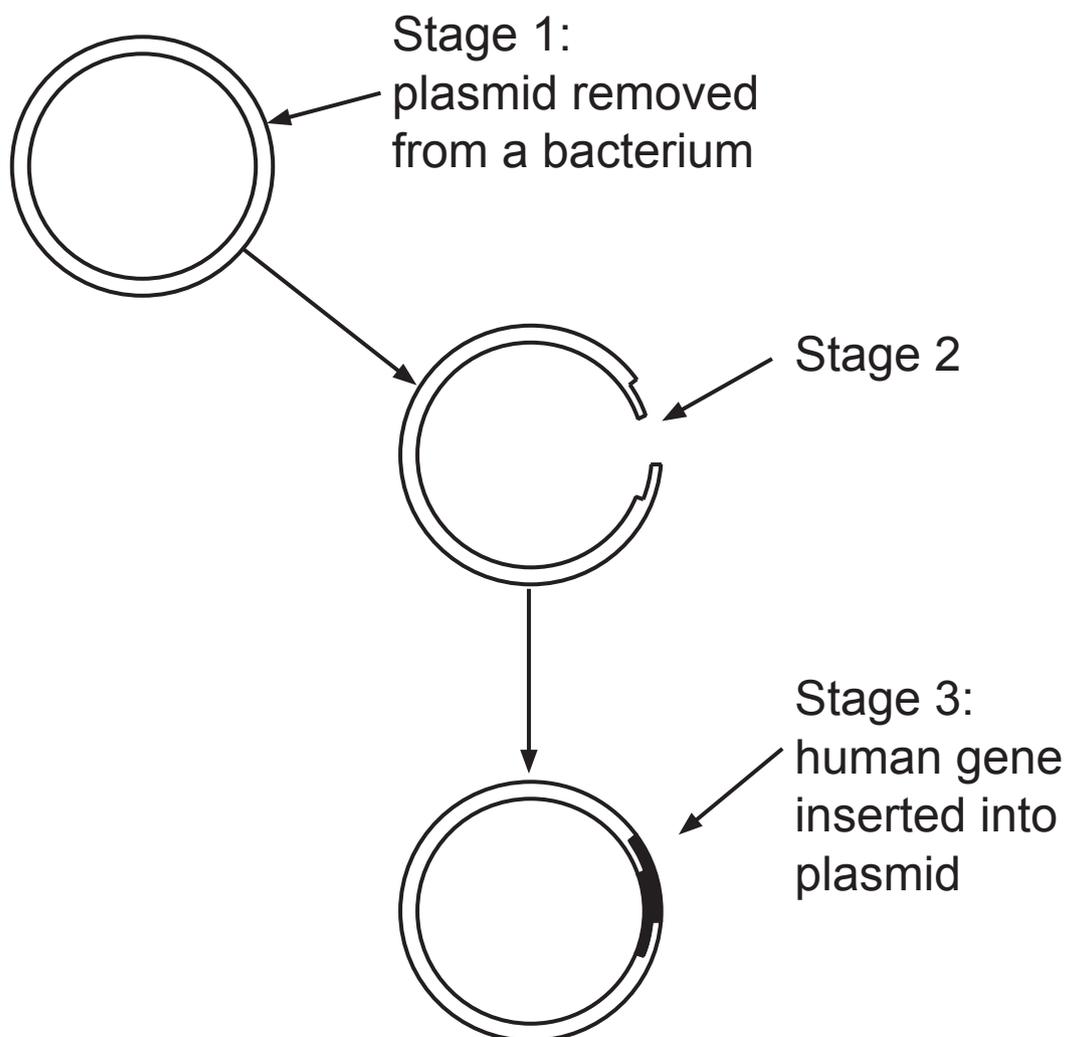
C T G C A G C C T A C T G C A C G G

G A C G T C G G A T G A C G T G C C

- (iii) How many sections of DNA will be produced when this length of DNA is cut by this enzyme? [1 mark]

- (c) In genetic engineering, a length of DNA is cut using this enzyme to produce a gene which can be inserted into a bacterial plasmid, to produce a human protein.

The diagram below shows some of the stages in genetic engineering.



- (i) What has happened to the plasmid at stage 2?  
[1 mark]
-

(ii) After stage 3, what are the next **two** stages needed to produce the human protein? [2 marks]

1. \_\_\_\_\_

2. \_\_\_\_\_

The final step in the process of genetic engineering is downstreaming.

(iii) Give **two** stages in downstreaming and explain why it is carried out. [3 marks]

Stage 1 \_\_\_\_\_

Stage 2 \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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**This is the end of the question paper**

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**SOURCES:**

Q2(a) .....© Pixologicstudio / Science Photo Library

Q8(b) .....© Barking Dog Art. Used with permission

For Examiner's use only	
Question Number	Marks
1	
2	
3	
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5	
6	
7	
8	
9	

<b>Total Marks</b>	
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Examiner Number

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