



General Certificate of Secondary Education  
2016

Centre Number

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Candidate Number

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# Biology

Unit 2  
Higher Tier



[GBY22]

\*GBY22\*

FRIDAY 17 JUNE, MORNING

## TIME

1 hour 45 minutes.

## 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 outside the boxed area on each page or on blank pages.**

Complete in blue or black ink only. **Do not write with a gel pen.**

Answer **all fourteen** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 115.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Questions **4** and **14(c)**.



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\*36GBY2202\*



1 The table gives information on some diseases caused by microorganisms.

Complete the table.

Disease	Type of microorganism	How disease is spread	Prevention
Measles		Droplet infection	
Athlete's foot		Contact	Wearing flip flops in a swimming pool area
	Bacterium	Eating contaminated food	Cook food thoroughly
Chlamydia	Bacterium		Use a condom

[5]



- 2 A group of students used a weight potometer to investigate the water loss of three different plants after 5 days.

The table shows the results.

Plant	Loss in mass after 5 days /g	Average rate of water loss /g per day
A	8.0	
B	10.0	2.0
C	5.0	1.0

Adapted from: [www.teamsciencerocks.com](http://www.teamsciencerocks.com)

- (a) Complete the table by calculating the average rate of water loss for plant A.

Show your working.

[2]

- (b) Suggest two **environmental** factors the students should have controlled during this investigation.

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

[1]

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

[1]



The students then counted the number of stomata found on the leaves of each plant.

They calculated the average number of stomata per mm<sup>2</sup>.

The table shows the results.

Plant	Average number of stomata per mm <sup>2</sup> of leaf surface
A	51
B	74
C	18

(c) Use data from **both tables** to describe and explain the results of the investigation.

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[4]

[Turn over

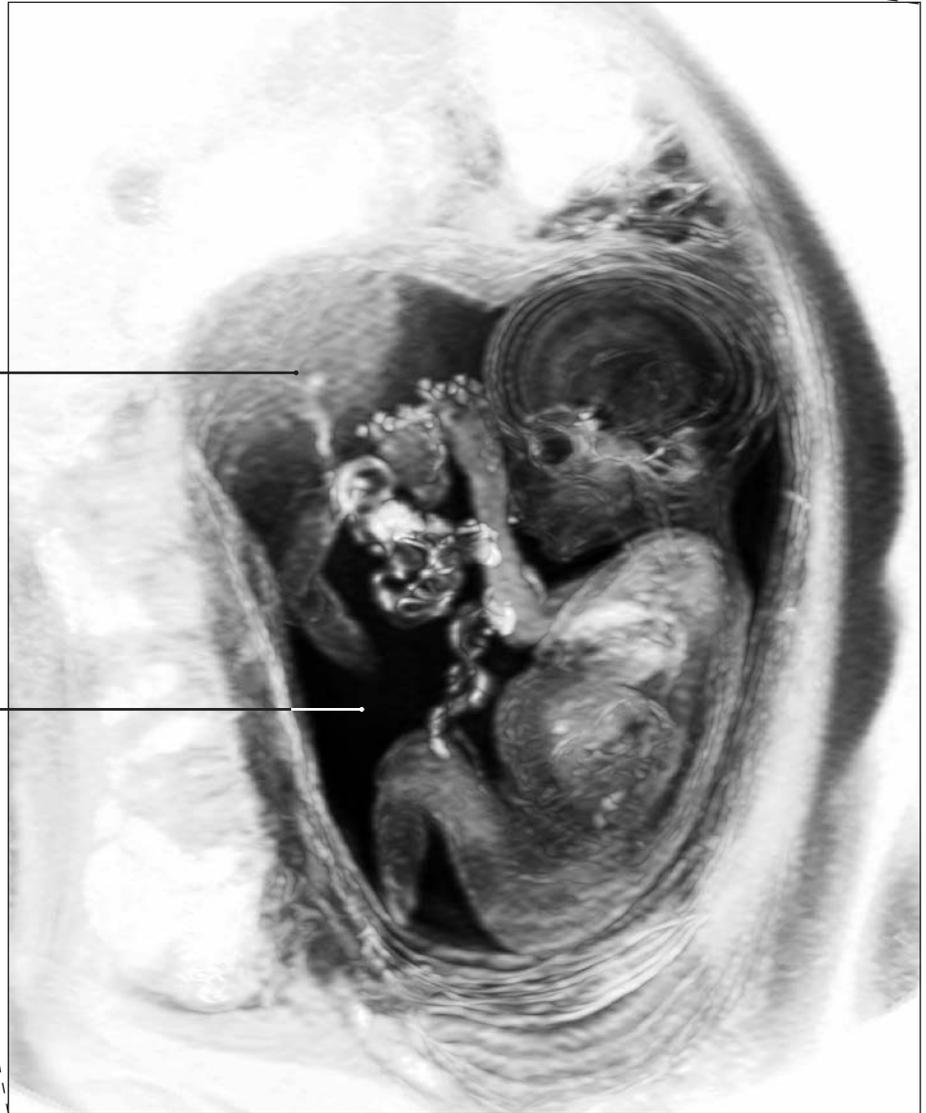


3 The photographs show a pregnant woman and the scan of her foetus.



placenta

space A



© Ghislain & Marie David De Lossy / Science Photo Library  
© Du Cane Medical Imaging Ltd / Science Photo Library



Look at the photographs.

(a) (i) Name the liquid found in space **A**.

\_\_\_\_\_ [1]

(ii) Explain how the liquid in space **A** protects the foetus.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(b) The function of the placenta is to exchange dissolved substances between the mother and the foetus.

(i) Explain how the structure of the placenta is adapted for this function.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(ii) Name **one** substance that is exchanged from the foetus to the mother.

\_\_\_\_\_ [1]

[Turn over



- 4 The table shows the chance of pregnancy occurring when using different types of contraception.

Type of contraception	Chance of pregnancy
Surgical	1 in 200
Mechanical	10 in 200
Chemical	2 in 200

An implant is a contraceptive device that works in a similar way to the pill.

It involves a small tube inserted under the skin in the upper arm of the woman.

This tube slowly releases chemicals.





- 5 A ban on smoking in workplaces was introduced in one country in 2008.

The table shows the number of adults in the population who were treated each year for diseases caused by smoking.

Disease	Number of adults treated each year				
	2008	2009	2010	2011	2012
Lung cancer	2700	3100	2600	2350	2000
Heart disease	4000	3800	3500	3150	2800

- (a) Suggest what effect the smoking ban had on the health of the population.

Use **data** from the table to support your answer.

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[3]

- (b) Suggest why the number of adults treated for lung cancer increased in the year after the smoking ban was introduced.

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[1]

- (c) Give **one** way lung cancer can be treated.

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[1]





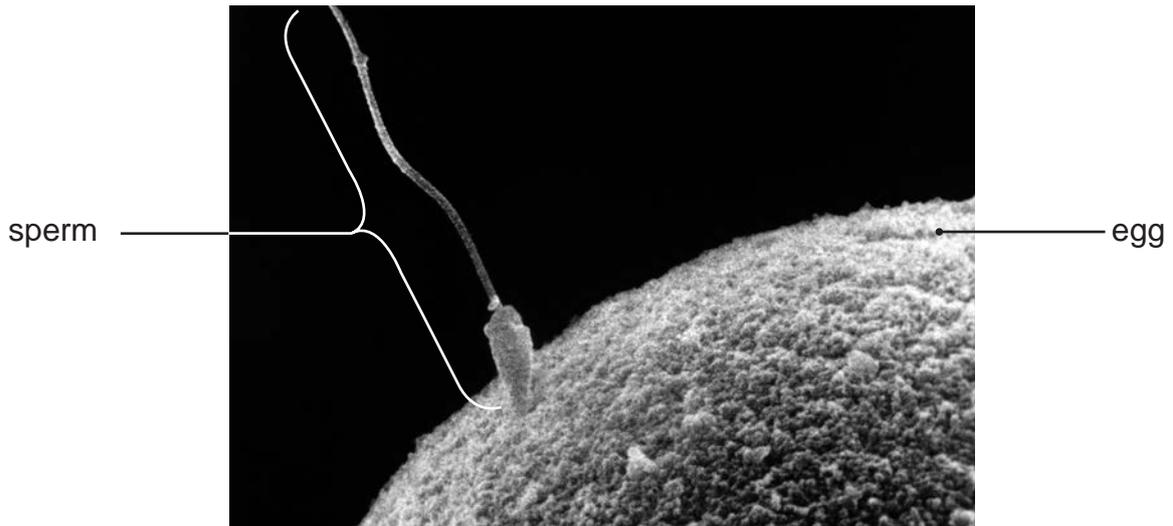
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**(Questions continue overleaf)**



6 The photograph shows a sperm and an egg before fertilisation.



© Don Fawcett / Science Photo Library

(a) Name **two** parts of the sperm visible in the photograph that adapt it to its function.

1. \_\_\_\_\_ [1]

2. \_\_\_\_\_ [1]

(b) (i) What evidence in the photograph suggests that this sperm is about to fertilise the egg?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(ii) Describe what happens during fertilisation.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]



**(c)** Where in the female reproductive system does fertilisation take place?

\_\_\_\_\_ [1]

**(d)** Name the cell produced by fertilisation.

\_\_\_\_\_ [1]

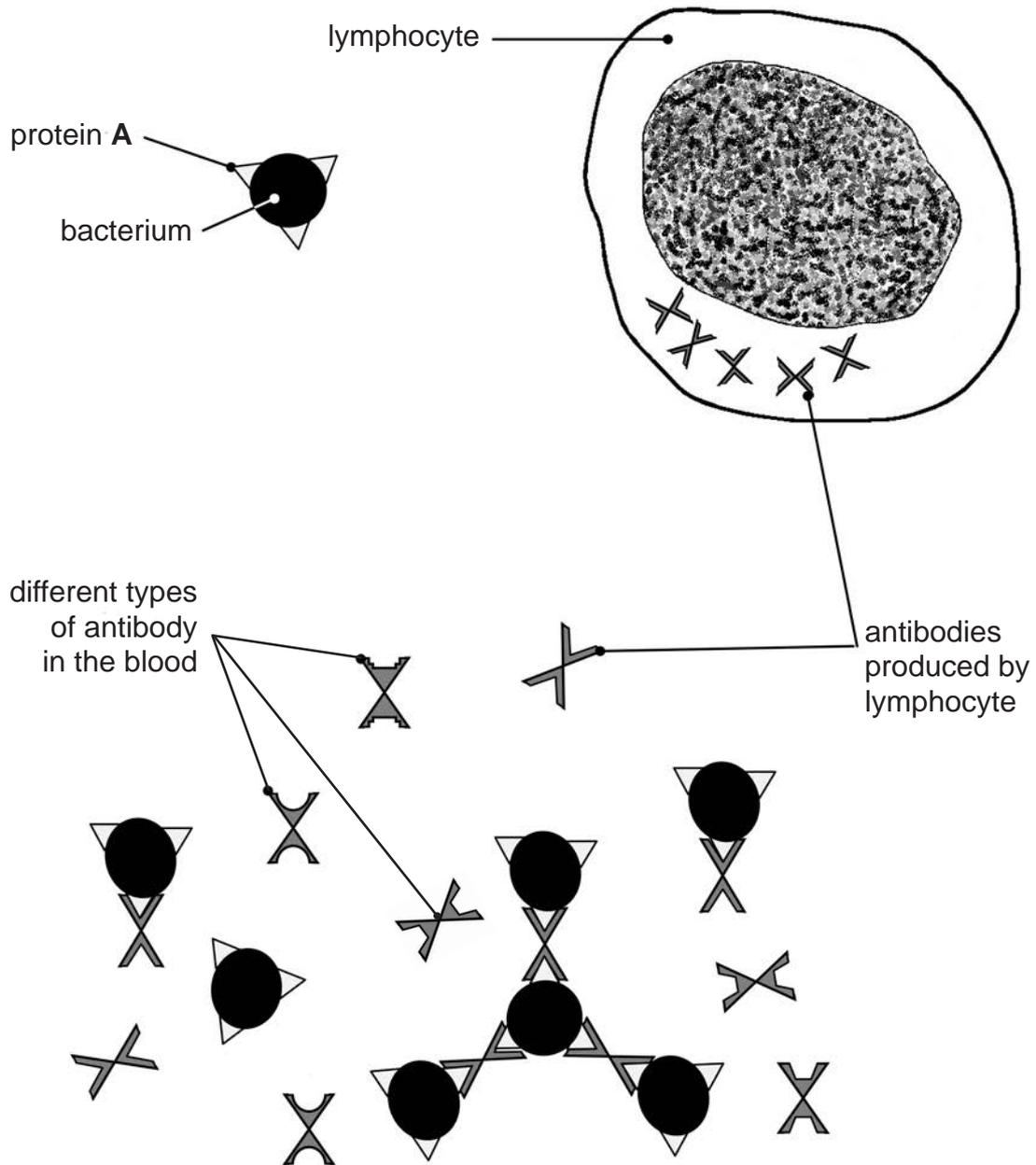
**(e)** What happens to the cell produced by fertilisation before it implants in the uterus lining?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

[Turn over



- 7 The diagram shows a lymphocyte cell producing antibodies in response to bacteria entering the blood.



© Chief Examiner

(a) Name protein A.

\_\_\_\_\_

[1]



(b) Lymphocytes bring about immunity by producing antibodies.

Name this type of immunity.

\_\_\_\_\_

[1]

(c) Suggest why there are different types of antibodies already present in the blood.

\_\_\_\_\_

\_\_\_\_\_ [1]

(d) Use the diagram to help describe and explain the action of the **antibodies** on the bacteria.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

After the action of the antibodies, another type of white blood cell destroys the bacteria.

(e) Name this type of white blood cell and describe how it destroys the bacteria.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

(f) Give **two** ways the body can prevent bacteria entering the blood.

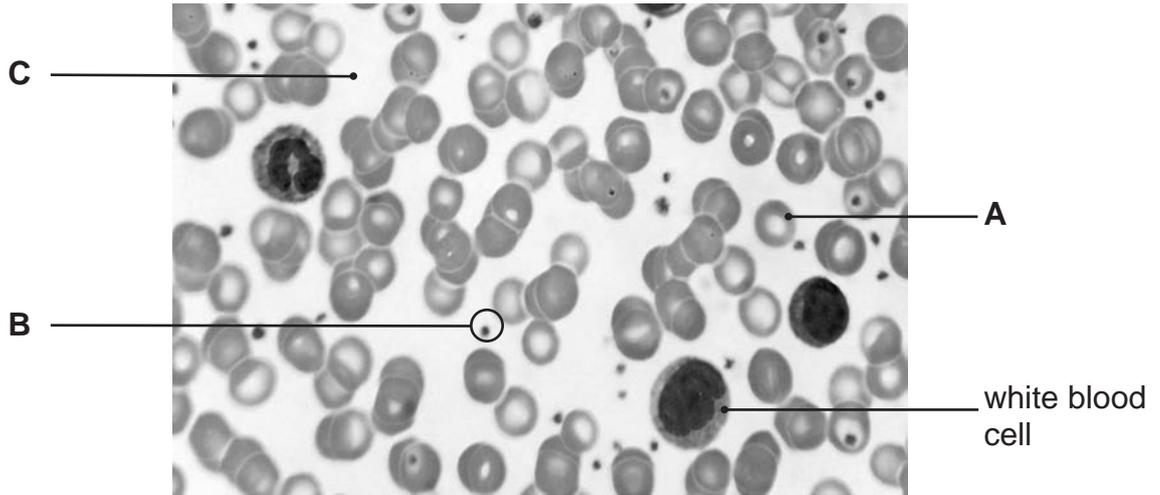
1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

[Turn over



8 (a) The photograph shows a blood smear viewed under a microscope.



© Dr. Fred Hossler, Visuals Unlimited / Science Photo Library

(i) Complete the table.

Label	Name of blood component	Function
A	Red blood cell	
B		Fibrinogen → fibrin
C		

[4]

(ii) Describe **two** differences, visible in the photograph, between the red and white blood cells.

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

\_\_\_\_\_ [1]

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

\_\_\_\_\_ [1]



(iii) Give **one other** way a red blood cell is adapted to its function.

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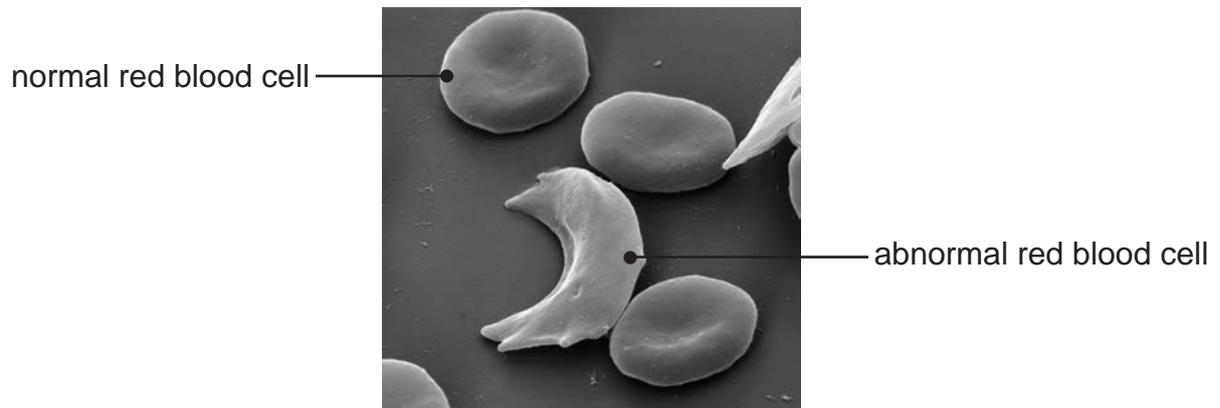
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[1]

The photograph shows the red blood cells of a patient with a genetic disease.

Some of the red blood cells are an abnormal shape.



© Eye of Science / Science Photo Library

(b) Patients with this disease lack energy and become tired easily.

Suggest why.

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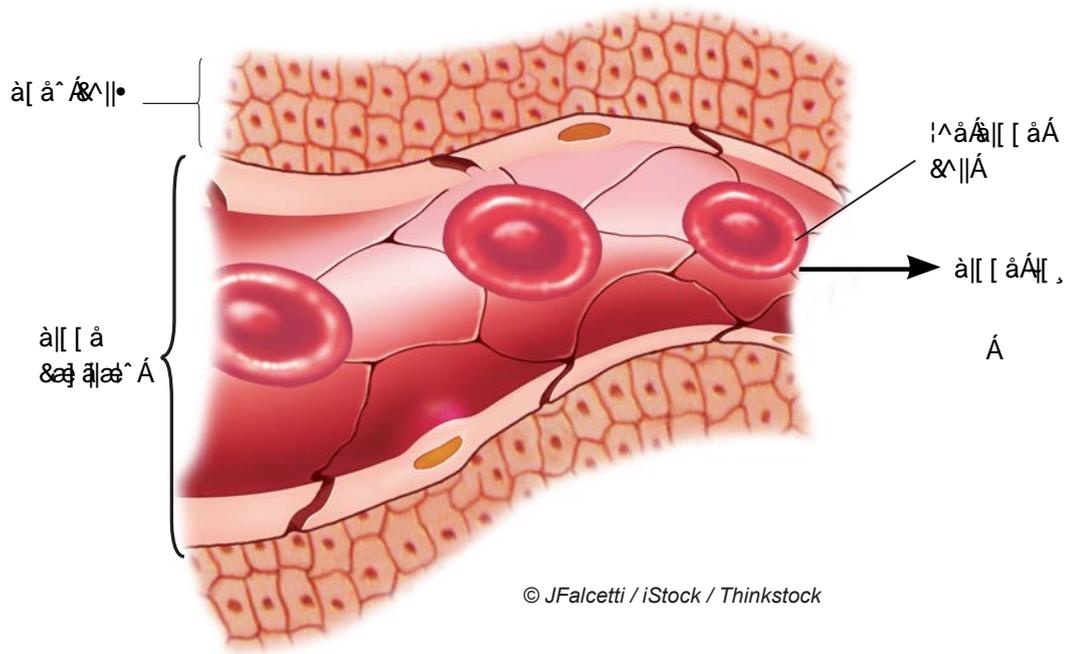
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[2]

[Turn over



The photograph shows a capillary surrounded by body cells.



(c) The rate of flow of red blood cells through the capillary helps the exchange of gases between the blood and the body cells.

Use evidence from the photograph to explain how.

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[3]



9 Complete the table summarising the work of some of the scientists who helped discover the structure of DNA.

Scientists	Approach used	Main discovery
		Base pairing
Franklin and Wilkins		Overall shape of DNA
	Modelling	

[5]



10 (a) DNA from different people has similarities but it also has differences that cause each person to be unique.

(i) Describe the **similarities** in the structure of DNA molecules from different people.

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[3]

(ii) Describe how DNA differs from one person to another making each of them unique.

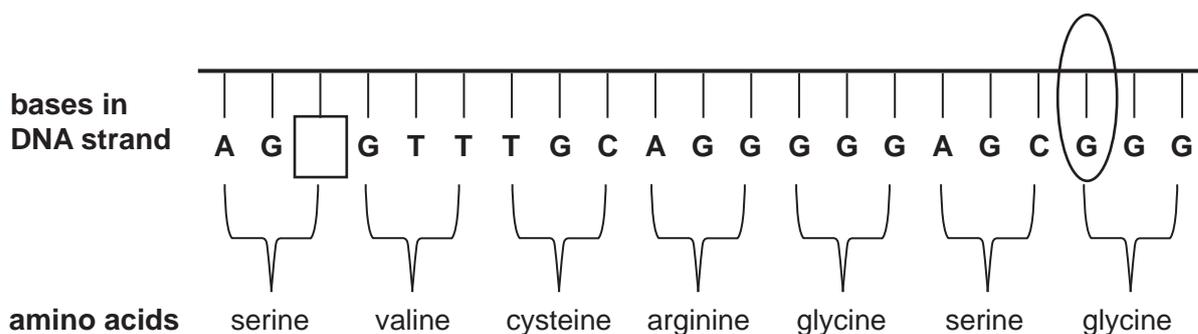
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[1]

(b) DNA codes for the sequence of amino acids in a protein.

The diagram shows a section of a DNA strand and the sequence of amino acids that will be produced.



(i) Use the information in the diagram to give the letter of the missing base for the first amino acid.

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[1]



A mutation occurs in the DNA strand causing the base G, circled, to be replaced by another base, A.

- (ii) Use the diagram to describe and explain what effect this mutation will have on the **final protein** produced.

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[2]

[Turn over



11 The photograph shows two snails of the same species.

One snail has a dark banded shell while the other shell is yellow.

The banding pattern in these snails is controlled by genes.

The snails are often eaten by birds such as thrushes.

Dark banded snail

Yellow snail



Source: Principal Examiner.

Students sampled the different shell types of the snails in a woodland and grassland.

The table shows the results.

Shell type	Number of snails found	
	Woodland	Grassland
Yellow	46	89
Dark banded	78	49

(a) Use data to describe the difference in the total number of each type of snail.

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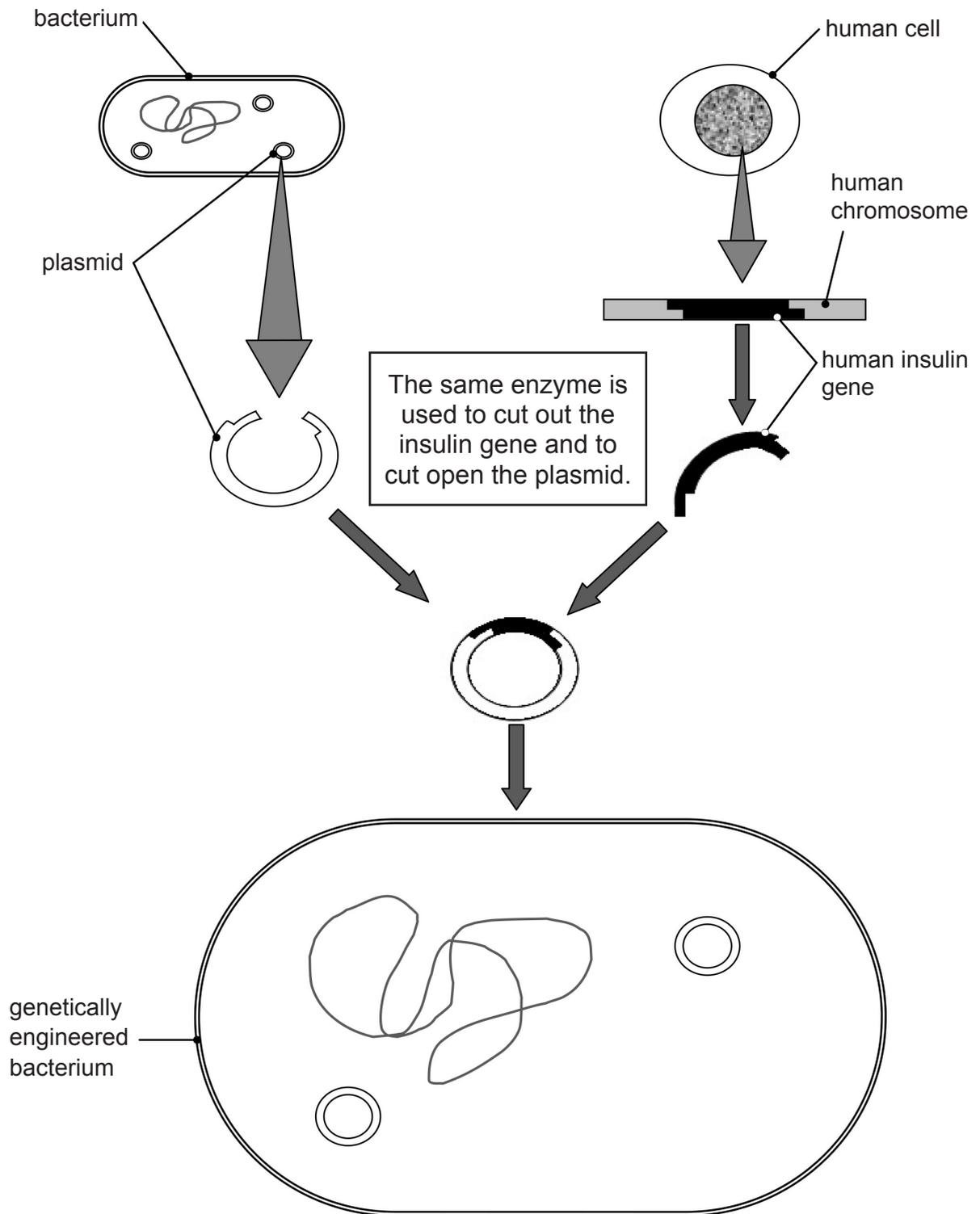
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[1]





12 (a) The diagram shows how bacteria can be genetically engineered to produce human insulin.



© Chief Examiner



(i) Complete the diagram of the genetically engineered bacterium. [1]

(ii) Name the type of enzyme used to cut out the human insulin gene and to cut open the plasmid.

\_\_\_\_\_

[1]

(iii) Explain why the same enzyme must be used to cut out the insulin gene and to cut open the plasmid.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[3]

(iv) Describe how this genetically engineered bacterium could be used to produce large quantities of human insulin **before** the insulin is downstreamed.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

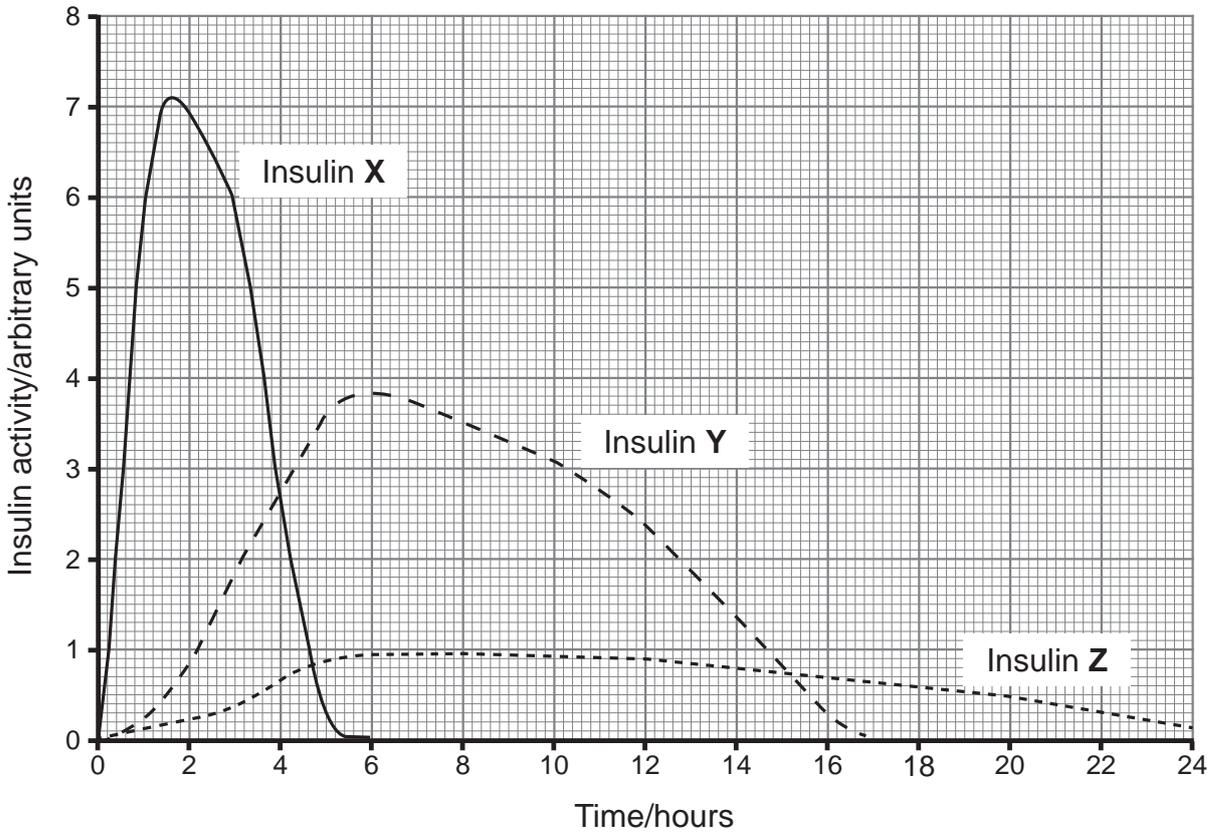
[2]

[Turn over



Genetic engineering can be used to produce different types of insulin for the treatment of diabetes.

The graph shows the activity of three types of insulin.



© "These illustrations are made available by written permission of The Regents of the University of California. All rights reserved."



The blood glucose level of a patient suffering from diabetes rises rapidly after a meal.

(b) Suggest which type of insulin would be best to treat this patient.

Explain your choice and include **data** from the graph to support your answer.

Type of insulin \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_ [3]



13 (a) Haemophilia is a genetic disorder which is sex-linked.

What is sex-linkage?

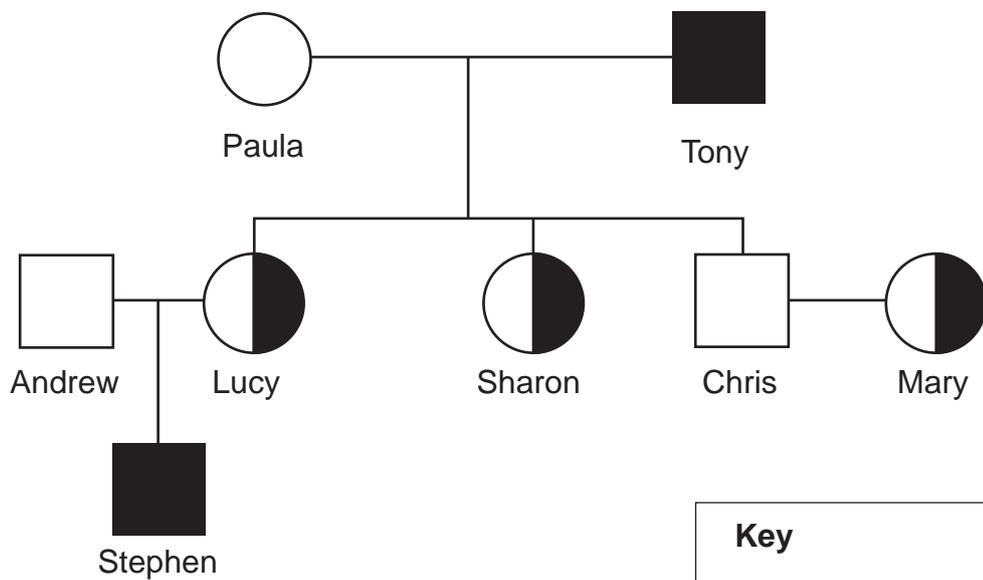
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[1]

(b) The diagram shows a family tree.



**Key**

- normal female
- normal male
- ◐ carrier female
- haemophiliac male



(i) What is the relationship of Stephen to Tony?

[1]

\_\_\_\_\_

Let

$X^H$  represent a normal X chromosome.

$X^h$  represent an X chromosome carrying the haemophilia allele.

Y represent a Y chromosome.

(ii) Explain why Chris is a normal male even though his father is haemophiliac.

[2]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(iii) Explain why haemophiliac males are more common than haemophiliac females.

[2]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Look at the family tree in part (b) on page 28.

(c) Chris and Mary have children.

(i) Complete the Punnett square to show Mary's gametes and the possible genotypes of Chris and Mary's children.

		<b>Mary</b>	
<b>Chris</b>	Gametes		
	$X^H$		
	Y		

[3]

Genetic screening involves testing an individual for the presence of a genetic condition caused by a particular allele.

Chris and Mary turned down the offer of genetic screening before having their children.

(ii) Explain how Chris and Mary could have benefited from genetic screening.

Use evidence from the Punnett square to support your answer.

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[3]





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14 Osmosis has a different effect on animal and plant cells.

(a) Explain what happens to a red blood cell when it is placed in water.

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[4]

(b) Describe and explain why osmosis has a different effect on plant cells when placed in water.

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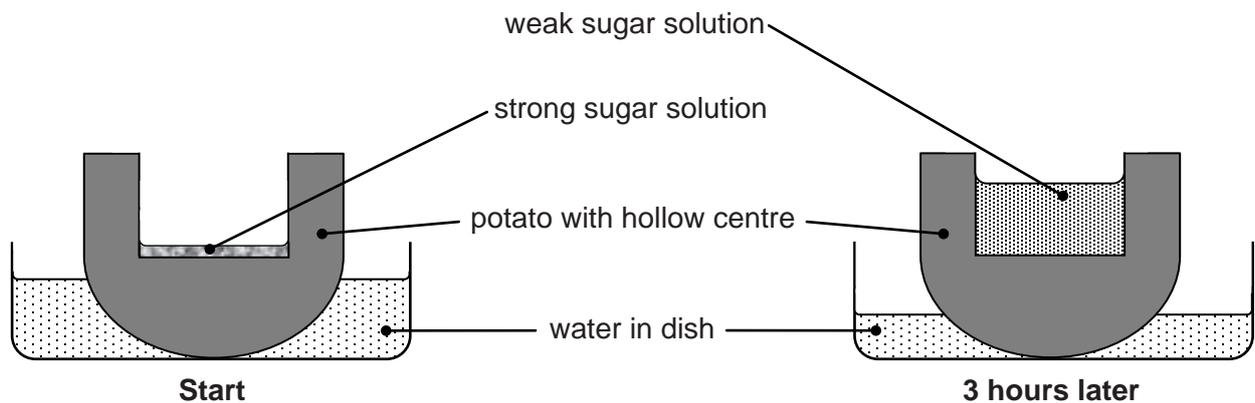
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[3]

The diagrams show an experiment carried out over three hours.





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