CCEA GCSE BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT 2 HIGHER TIER GBY22 PAPERS

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016

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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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]

[Turn over

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

(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^2.

The table shows the results.

Plant	Average number of stomata per mm^2 of leaf surface
A	51
B	74
C	18

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

_____

_____

_____

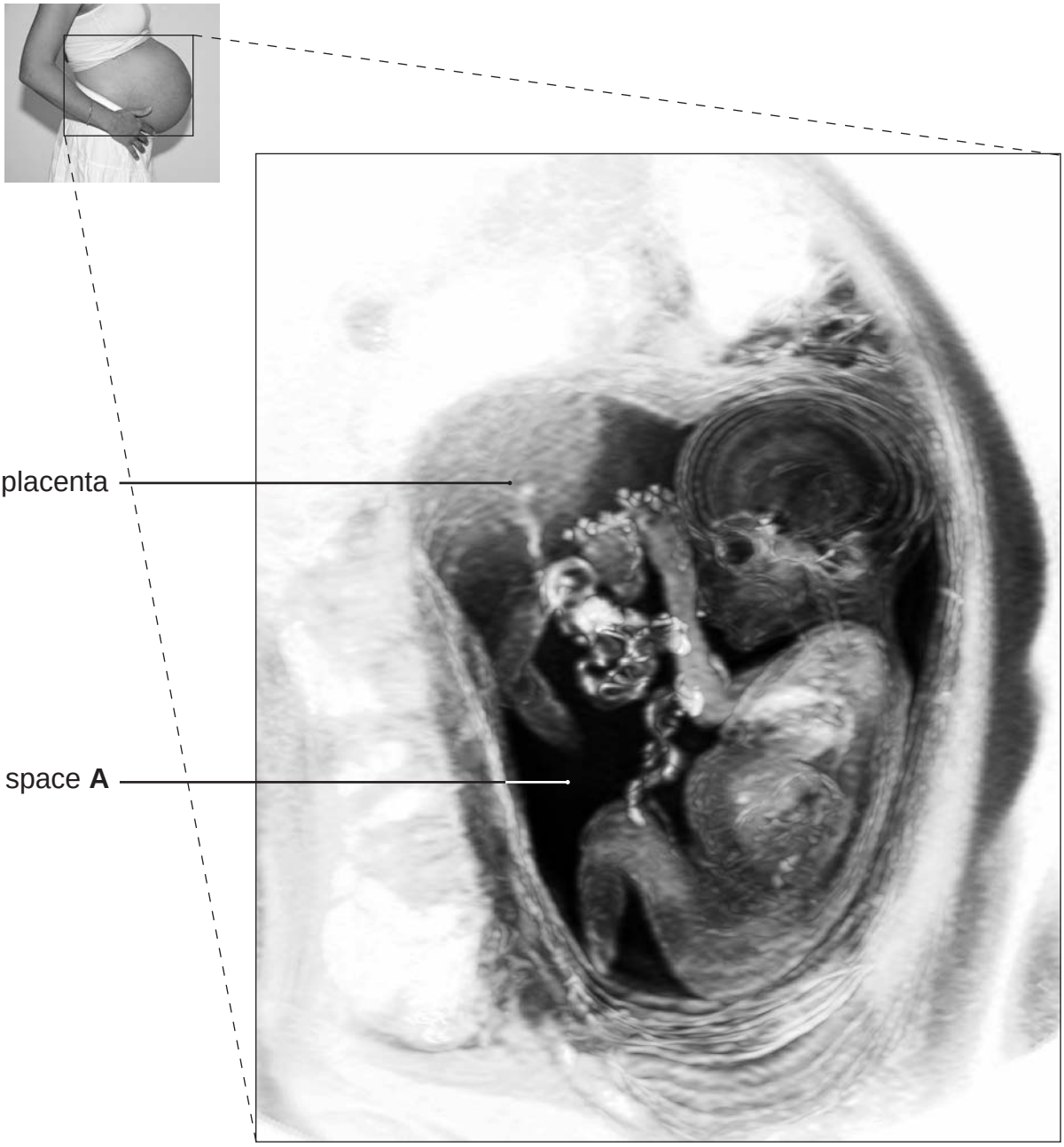
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_____

_____ [4]

[Turn over

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



© 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 occuring 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.

Use the information and your knowledge to answer the following questions.

- What type of contraceptive is the implant?
- Describe how the chance of pregnancy using an implant compares to surgical and mechanical types of contraception given in the table.
- Suggest **two other** advantages and **one** disadvantage of using this method when compared to the others.

In this question you will be assessed on your written communication skills, including the use of specialist scientific terms.

_____ [6]

[Turn over

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.

_____

_____

_____

_____

_____

_____ [3]

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

_____

_____

_____ [1]

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

_____ [1]

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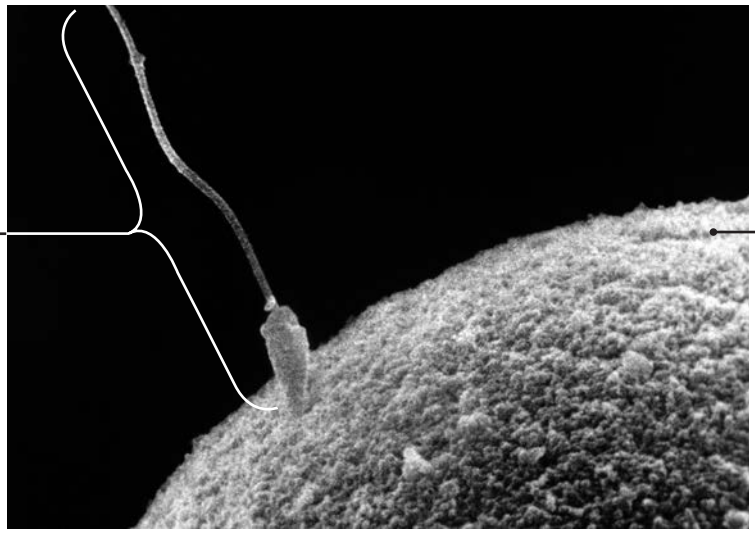
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(Questions continue overleaf)

[Turn over

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]

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(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?

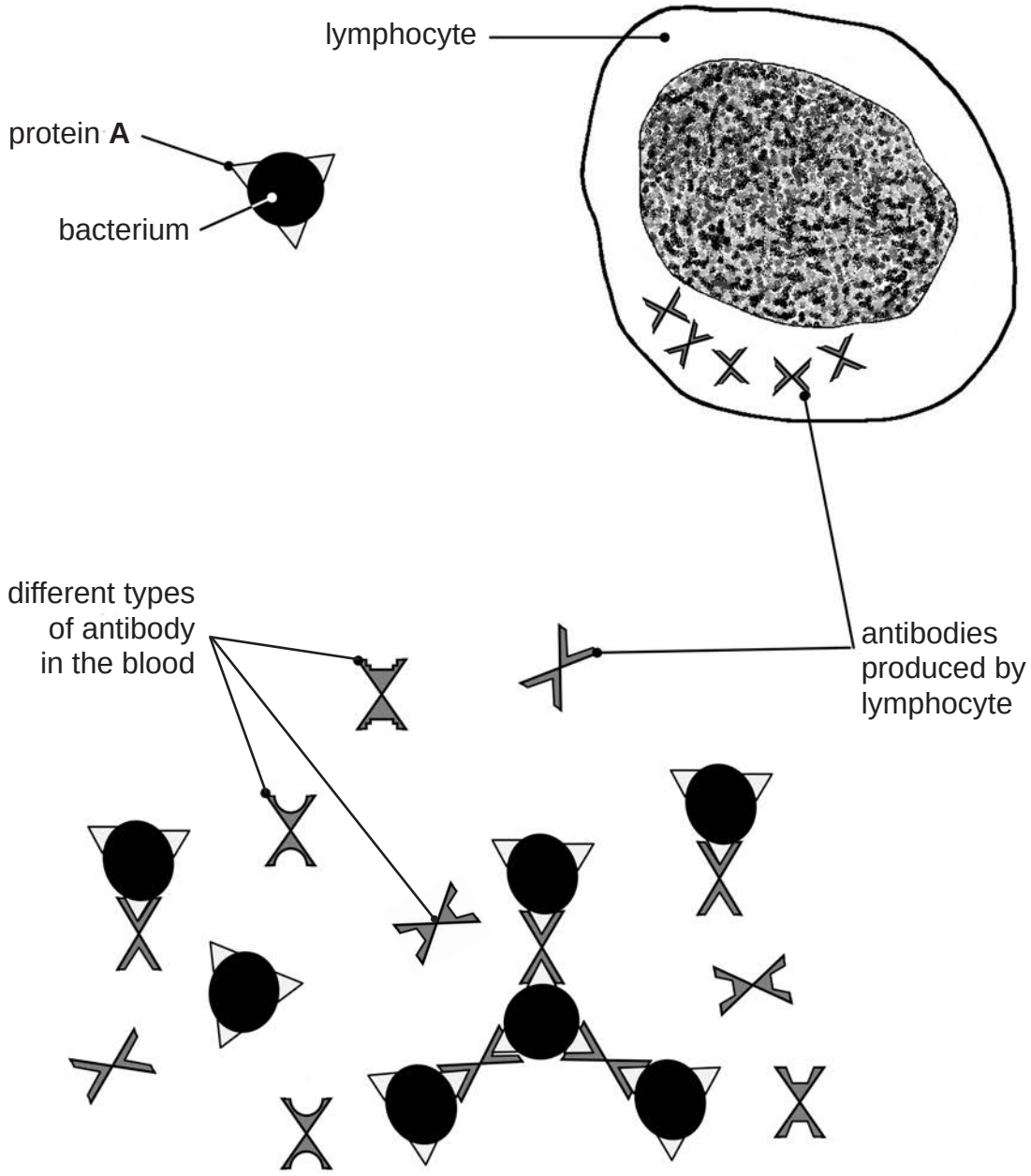
_____

_____

_____ [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]

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(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]

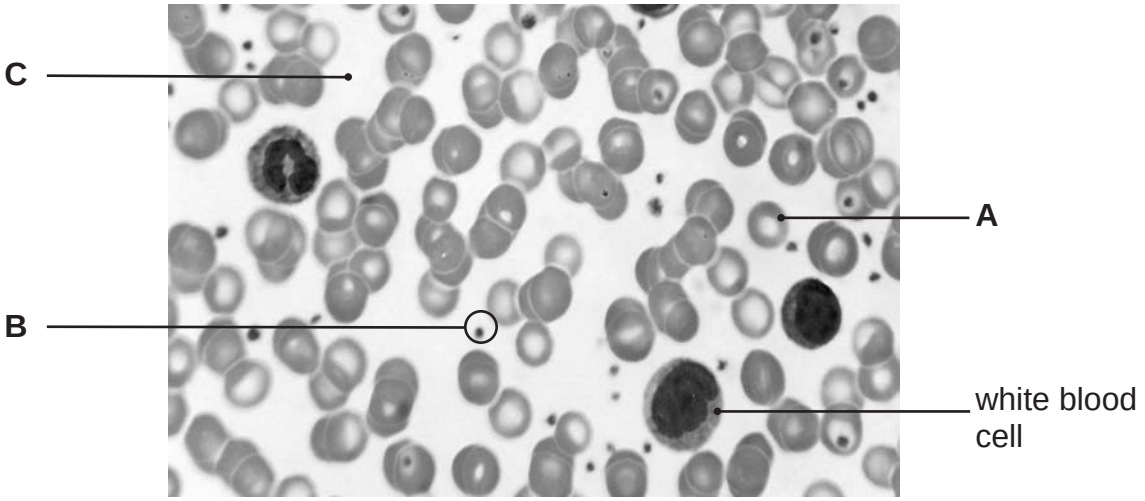
(f) Give **two** ways the body can prevent bacteria entering the blood.

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]

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

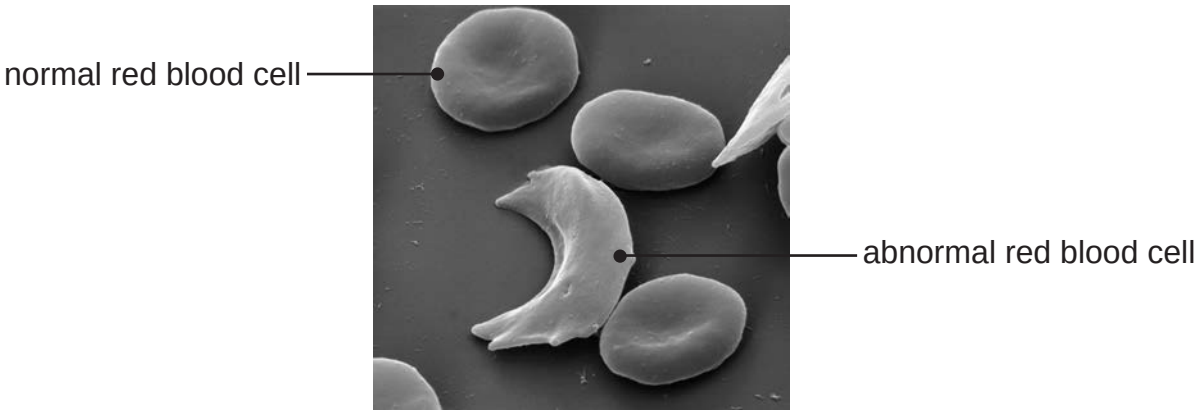
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_____

_____ [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.

_____

_____

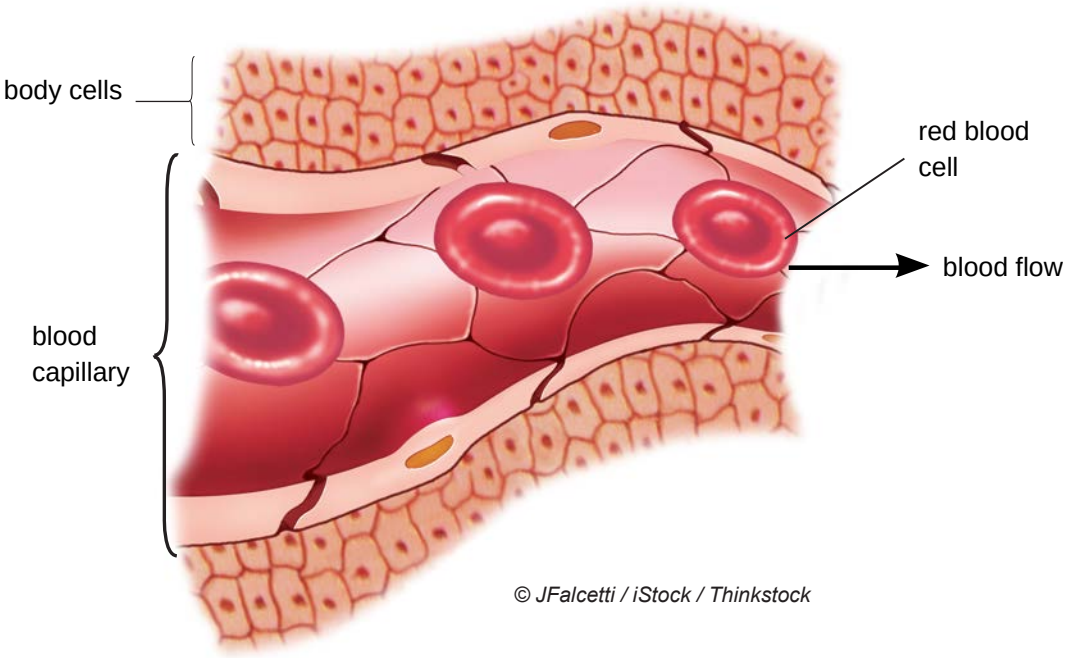
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_____

_____ [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.

_____

_____

_____

_____

_____

_____ [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]

[Turn over

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.

_____

_____

_____

_____

_____ [3]

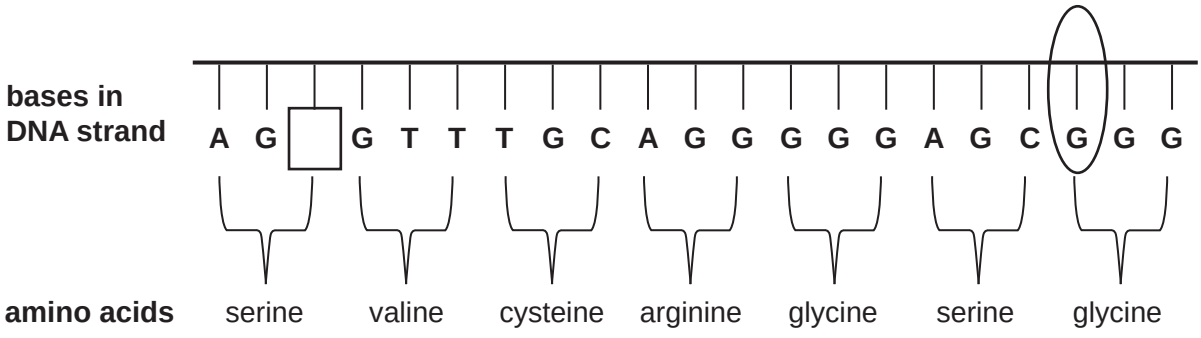
(ii) Describe how DNA differs from one person to another making each of them unique.

_____

_____ [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.

_____ [1]

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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.

_____

_____

_____

_____

_____

_____

_____ [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.

_____

_____ [1]

(b) Describe **two other** trends in the data.

_____

_____

_____

_____ [2]

(c) Explain how natural selection could have caused this distribution of snails.

_____

_____

_____

_____

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_____

_____

_____

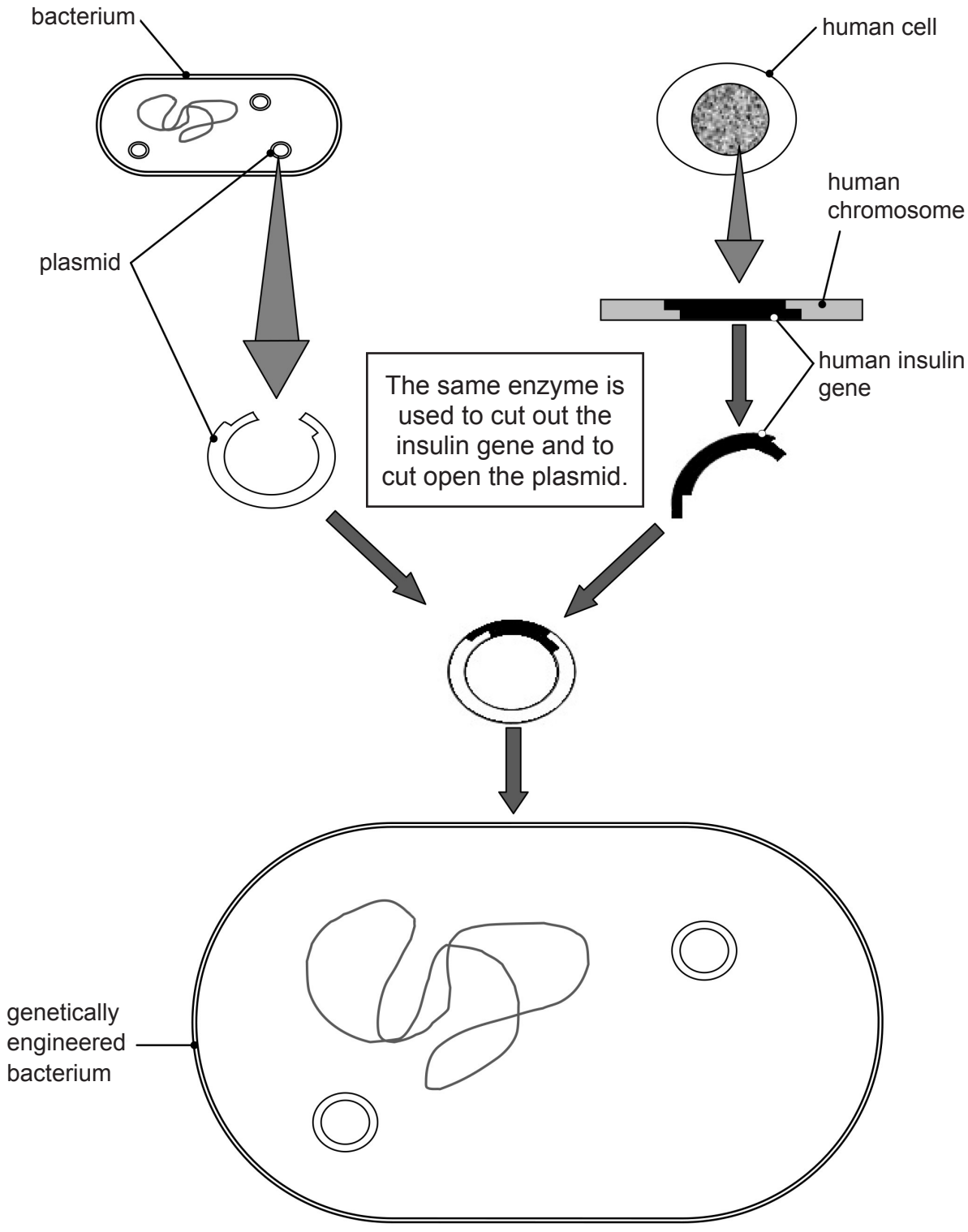
_____

_____

_____ [5]

[Turn over

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.

_____

_____

_____

_____

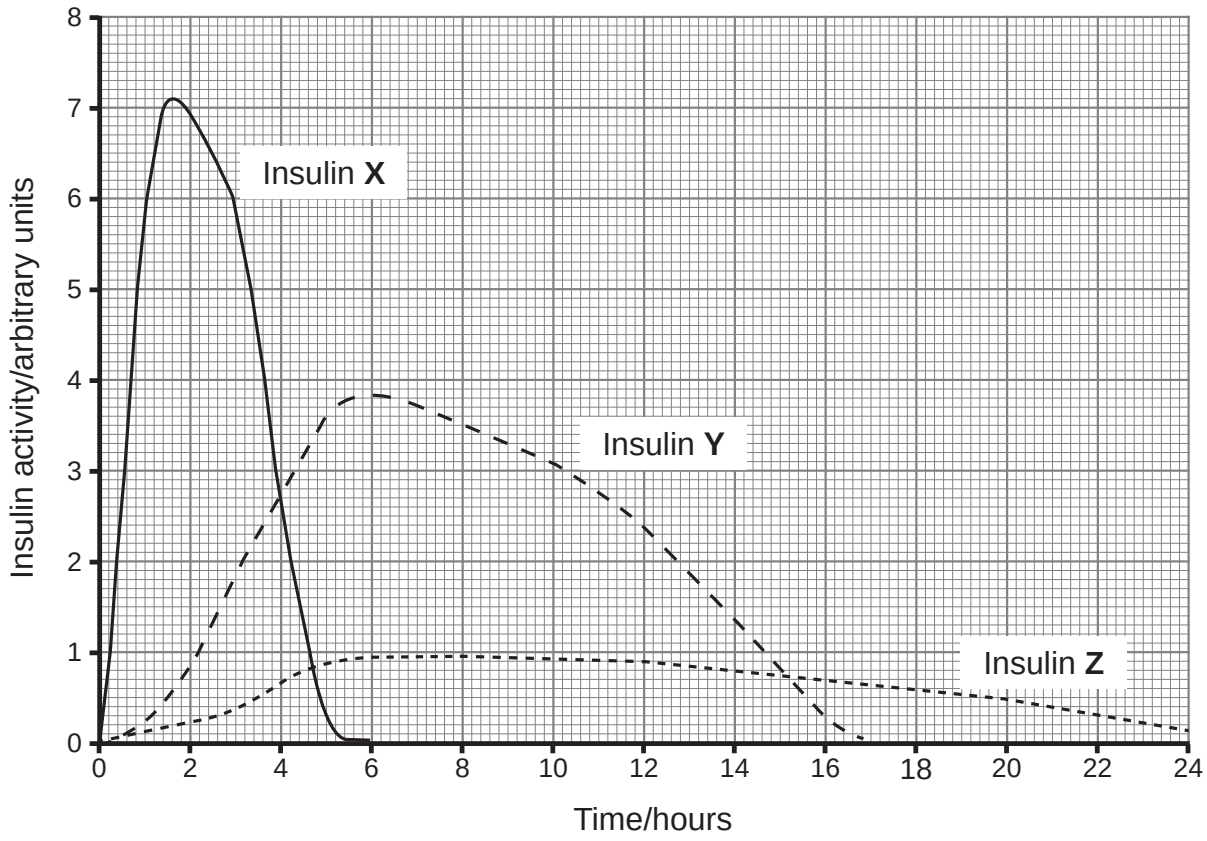
_____ [2]

[Turn over

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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 _____

_____

_____

_____

_____

_____

_____ [3]

[Turn over

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

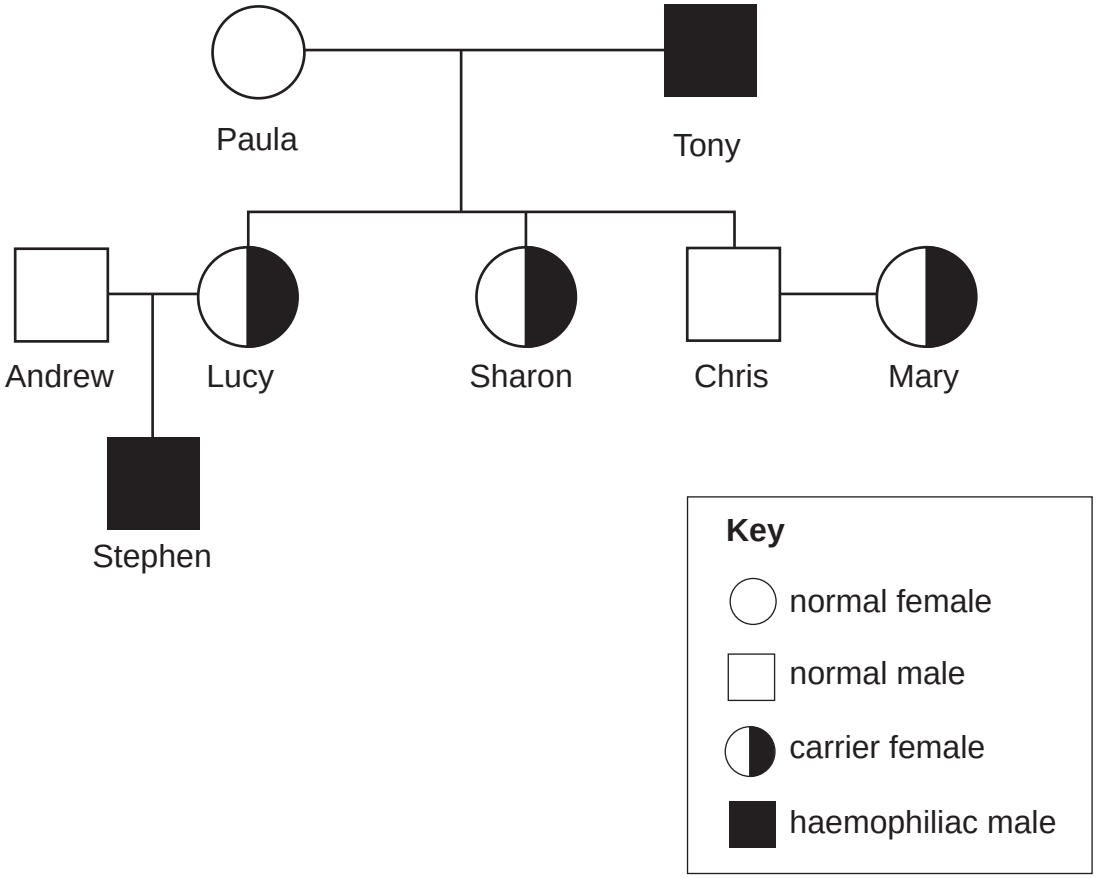
What is sex-linkage?

_____

_____

_____ [1]

(b) The diagram shows a family tree.



(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]

[Turn over

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.

		Mary	
	Gametes		
Chris	$\mathbf{X^H}$		
	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.

_____

_____

_____

_____

_____

_____

_____ [3]

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[Turn over

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.

_____

_____

_____

_____

_____

_____ [4]

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

_____

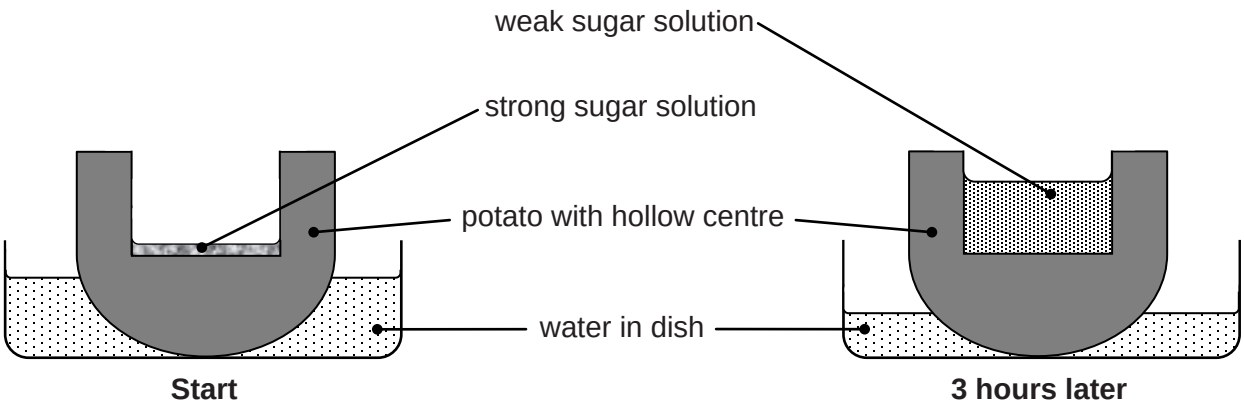
_____

_____

_____

_____ [3]

The diagrams show an experiment carried out over three hours.



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(c) Describe and explain the changes that occurred during the three hours.

Suggest why similar changes would not occur using a boiled potato.

In this question you will be assessed on your written communication skills, including the use of specialist scientific terms.

[6]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
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9	
10	
11	
12	
13	
14	
Total Marks	

Examiner Number

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General Certificate of Secondary Education
2016

GCSE Biology

Unit 2

Higher Tier

[GBY22]

FRIDAY 17 JUNE, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

				AVAILABLE MARKS
1	Virus; [1] Vaccination; [1] Fungus; [1] Salmonella; [1] Sexual intercourse; [1]		[5]	5
2	**(a)**	8 ÷ 5; [1] 1.6; [1]	[2]	
	(b)	Any **two** from: Wind [speed]; Temperature; Light; Humidity; Size of plant/number of leaves/surface area of leaves;	[2]	
	(c)	B has highest rate of water loss – 2 g per day/10 g in 5 days; [1] B – more stomata – 74; [1] (B – more) water transpires/diffuses/evaporates; [1] Through/via/out of stomata; [1] (Accept converse for C)	[4]	8
3	**(a)**	**(i)** Amniotic fluid;	[1]	
		(ii) Cushions the foetus;	[1]	
	(b)	**(i)** Large surface area/villi/good blood supply/thin membrane;	[1]	
		(ii) Carbon dioxide/nitrogen wastes;	[1]	4

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AVAILABLE MARKS

4 Indicative Content

1. Chemical;
2. Implant less chance of pregnancy than mechanical type; } ECT
3. Implant more chance of pregnancy than surgical types; } ECT

4 **and** 5. **Maximum of two** from:

Convenient;

Reversible;

Reduces bleeding;

Less risk than surgery;

6. Disadvantages – **one** from:
   May increase risk of blood clotting/May cause headaches/May cause tender breasts/Other appropriate answer;

Accept: bullet points which start with capital letter, contain a verb and end in full stop as sentences.

Band	Response	Mark
A	Candidates **must use appropriate, specialist terms** throughout **using <u>five</u> of the above points**. They use **good** spelling, punctuation and grammar and the form and style are of a **high standard**.	[5]–[6]
B	Candidates **use some appropriate, specialist terms** throughout **using <u>three</u> of the above points**. They use **satisfactory** spelling, punctuation and grammar and the form and style are of a **satisfactory standard**.	[3]–[4]
C	Candidates **make little use of specialist terms** throughout **using some or all of the above points**. The spelling, punctuation and grammar, form and style are of a **limited** standard.	[1]–[2]
D	Response not worthy of credit.	[0]

6

5 (a) Health improved; [1]
Fewer adults treated for **both** diseases; [1]
Lung cancer: 2700 → 2000/by 700; [1]
or heart disease: 4000 → 2800/by 1200;
or totals 6700 → 4800/1900; [3]

(b) Time lag between time of ban and diagnosis of lung cancer/not enough time for smoking ban to take effect; [1]

(c) Surgery/chemotherapy/radiotherapy; [1]

5

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			AVAILABLE MARKS
6	**(a)**	Nucleus; [1] **Accept**: Head; Tail; [1] [2]	
	(b)	**(i)** Sperm [head] entering/touching egg; **Accept**: Described, e.g. Sperm attached to egg; [1]	
		(ii) nucleus/nuclei; [1] of sperm and egg fuse; [1] [2]	
	(c)	Oviduct; [1]	
	(d)	Zygote; [1]	
	(e)	Any **two** from: Divide/by mitosis; form a ball of cells/embryo; Travels down oviduct; [2]	9
7	**(a)**	Antigen; [1]	
	(b)	Active/acquired (not artificial unqualified); [1]	
	(c)	Produced in response to different/previous bacterial infections; [1]	
	(d)	Any **three** from: Shape of antibody matches antigens/specific/complementary; [1] Antibody attaches/binds to antigen/bacterium; [1] Binds/clumps bacteria together; [1] Prevents spread/reproduction/easier for phagocytes; [1] [3]	
	(e)	Phagocyte; [1] **Reject**: *white blood cell* Engulfs bacteria/clumps of bacteria; [1] Digests; [1] [3]	
	(f)	Any **two** from: Skin; Hairs/cilia; Mucous membranes; Tears/lysozyme; Stomach/vaginal acid; Blood clotting; [2]	11

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					AVAILABLE MARKS
8	**(a)**	**(i)**	Transport oxygen; [1] Platelet; [1] Plasma; [1] Transport; [1]	[4]	
		(ii)	Any **two** from: RBC – no nucleus, WBC – nucleus; [1] RBC smaller, WBC larger; (comparison required) [1] RBC is biconcave/WBC is not; [1] More RBCs (than WBC); [1]	[2]	
		(iii)	Any **one** from: Haemoglobin; Biconcave disc/large surface area; No nucleus;	[1]	
	(b)		Carries **less** oxygen; [1] Reduced (cell) **<u>respiration</u>**; [1]	[2]	
	(c)		Any **three** from: Only one RBC passes at a time/single file; [1] Slow flow/movement [in capillary]; [1] More time for exchange [of oxygen]; [1] By diffusion; [1]	[3]	12
9			Chargaff; [1] Chemical analysis; [1] X-ray diffraction [crystallography]; [1] Crick **<u>and</u>** Watson; [1] Double helix; [1]	[5]	5
10	**(a)**	**(i)**	Any **three** from: Backbone same; [1] Double helix; [1] Made of sugar/deoxyribose **and** phosphate; [1] A pairs with T/C with G; [1]	[3]	
		(ii)	Different **<u>sequences/order</u>** of bases;	[1]	
	(b)	**(i)**	C;	[1]	
		(ii)	Glycine replaced by arginine; [1] Different protein; [1]	[2]	7

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				AVAILABLE MARKS
11	**(a)**	More yellow 135 v 127/8;	[1]	
	(b)	Any **two** from: More yellow snails on grassland; [1] More dark banded snails in woodland; [1] More in total in grassland; **Accept converse**: Less in total woodland; [1] Number of yellow in woodland similar to dark in grassland; [1]	[2]	
	(c)	Yellow better camouflaged in grassland/dark banded better camouflaged in wood; [1] Less eaten by thrush/predation; [1] More survive; [1] Reproduce; [1] Pass yellow/dark-banded gene on; [1]	[5]	8
12	**(a)**	**(i)** One similar plasmid with insulin gene drawn inside bacterium;	[1]	
		(ii) Restriction [enzyme];	[1]	
		(iii) Exposed [DNA] bases on sticky ends (of gene); [1] Complementary/match to (bases in) cut in plasmid; [1] bind/bond together by base pairing; [1]	[3]	
		(iv) Any **two** from: Bacterium is grown/cultured/reproduces/in fermenter/biodigester; Bacteria **all/each** produce insulin;	[2]	
	(b)	X; [1] Activity reaches a maximum quickly; [1] Max = 7.1 arbitrary units in 96 minutes/1 hour 36 minutes/active for 5.4 hours; [1]	[3]	10
13	**(a)**	Carried on X chromosome/sex chromosome;	[1]	
	(b)	**(i)** Grandson;	[1]	
		(ii) Chris receives normal X chromosome (X^H) from his mother; [1] Receives Y chromosome from his father; [1]	[2]	
		(iii) Any **two** from: ♂ would have to receive only 1 recessive/X^h allele; Y chromosome does not carry the haemophiliac gene; ♀ would have to receive 2 recessive/X^h alleles;	[2]	
	(c)	**(i)** Mary's gametes: X^H X^h; [1] Genotype of children: $X^H X^H$ $X^H X^h$; [1] $X^H Y$ $X^h Y$; [1]	[3]	
		(ii) Any **three** from: Test would have shown Mary is a carrier; [1] Half her daughters could be carriers/25% chance of (girl) carrier; [1] Half her sons would be haemophiliacs/25% chance of having haemophiliac son; [1] Could have decided to adopt/not have children [1]	[3]	12

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14 (a) Any **four** from:
Water enters into/absorbed by cell/cell swells/fills;
by diffusion;
Down concentration gradient/described;
By osmosis/through selectively permeable membrane;
Causes **lysis**; [4]

(b) Any **three** from:
Cell wall;
Resists outwards force (movement) of cell membrane/vacuole;
Causes pressure increase/cell becomes **turgid/turgor**;
Stops water entering/limits water uptake; [3]

(c) **Indicative content:**

1. Water level in dish falls because water moves from dish into potato tissue/cells;
2. Water level in hollow of potato rises/sugar solution rises because water moves from the potato tissue;
3. Osmosis;
4. Sugar solution becomes more dilute;
5. Correct description of one of the concentration gradients involved:
   From water to dilute/weak/low concentration solution in the potato tissue/cells/vacuole **or**
   From dilute/weak/low concentration solution in the potato tissue/cells/vacuole to concentrated/strong/high concentration of sugar [solution];
6. Boiled potato damages membranes/loses selective permeability;

(**Accept**: bullet points which start with capital letter, contain a verb and end in full stop as sentences.)

Band	Response	Mark
A	Candidates **must use appropriate, specialist terms** throughout **using five of the above points**. They use **good** spelling, punctuation and grammar and the form and style are of a **high** standard.	[5]–[6]
B	Candidates **use some appropriate, specialist terms** throughout **using three of the above points**. They use **satisfactory** spelling, punctuation and grammar and the form and style are of a **satisfactory** standard.	[3]–[4]
C	Candidates make **little use of specialist terms** throughout **using some or all of the above points**. The spelling, punctuation and grammar, form and style are of a **limited** standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6] 13

Total **115**

AVAILABLE MARKS

Rewarding Learning

General Certificate of Secondary Education
2015

Biology

Unit 2

Higher Tier

[GBY22]

MONDAY 15 JUNE, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

Introduction

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The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**		continuous;	[1]	
	(b)	**(i)**	Tally completed correctly; Numbers: 1, 2, **5**, **1**, **1**;	[2]	
		(ii)	Histogram;	[1]	
		(iii)	3/10 × 100; = 30;	[2]	
		(iv)	Small sample size;	[1]	
	(c)	**(i)**	Diet/calcium/proteins/vitamin D;	[1]	
		(ii)	Genetic;	[1]	9
2	**(a)**		Amniocentesis;	[1]	
	(b)		Nucleus;	[1]	
	(c)		Down syndrome;	[1]	
	(d)		Mutation;	[1]	
	(e)		Different genders/A male, B female/different sex chromosomes/ A–XY, B–XX/different numbers of chromosomes (described);	[1]	
	(f)		Abortion (for medical reasons); Risk of miscarriage (caused by screening);	[2]	7

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			AVAILABLE MARKS
3	**Indicative content** 1 Water has **moved out** of cells; 2 Down concentration gradient/described; 3 Through selectively/partially permeable membranes; 4 Cytoplasm shrank; 5 Cell membrane pulls away from cell wall; 6 Cells (in concentrated solution) become plasmolysed; 7 Cell wall permeable to sugar solution/sugar can pass through cell wall; 8 Sugar solution enters inside cell wall; 9 Sugar does not enter cell membranes/membranes impermeable to sugar;		

Response	Marks
Candidates **must use appropriate, specialist terms** throughout to describe the process of osmosis **using <u>at least five</u> of the above points.** They use **good** spelling, punctuation and grammar and the form and style are of a **high standard**.	[5]–[6]
Candidates use **some appropriate, specialist terms** throughout to describe the process of osmosis using **<u>at least three</u> of the above points.** They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates make **little use of specialist terms** throughout to describe the process of osmosis **<u>using some or all</u> of the above points.** The spelling, punctuation and grammar, form and style are of a **limited** standard.	[1]–[2]
Response not worthy of credit	[0]

[6] 6

4 **(a)** Distance moved by bubble;
Time; [2]

(b) Any **four** from:
Results/trend shows increasing humidity reduces transpiration (rate);
80% humidity/in bathroom causes 0.3 mm (± 0.05) per minute;
20%/living room causes 1.7 (± 0.05) mm per minute;
Less diffusion gradient (in bathroom); [4] 6

5 **(a)** Artery thicker muscle/wall than vein;
Artery smaller lumen; [2]

(b) Prevent backflow; [1]

(c) Allow artery to stretch (under high pressure)/withstand high pressure;
Return to normal (after pulse); [2]

(d) carotid artery; [1]

(e) jugular vein; [1]

(f) Allow **time** for/**enough** diffusion of gases to occur; [1] 8

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					AVAILABLE MARKS
6	**(a)**	**(i)**	chromosome; [1]		
		(ii)	nuclear membrane disappears; [1]		
		(iii)	DNA replicates/each chromosome copies/doubles/duplicates; [1]		
		(iv)	**genetically** identical; [1]		
		(v)	asexual; [1]		
	(b)	**(i)**	1 long black chromosome and 1 short white chromosome in one cell; 1 long white chromosome and 1 short black chromosome in the other cell; [2]		
		(ii)	2 daughter cells in mitosis, 4 in meiosis; daughter cells have same number of chromosomes as parent cell in mitosis, daughter cells have half the number in meiosis/ diploid v haploid; daughter cells identical in mitosis, variation in meiosis; one v two divisions Any **two**, comparison needed [2]		
		(iii)	sperm/ovum/gamete; [1]		10
7	**(a)**		L drawn in chambers ①/③; [1]		
	(b)		①, ③, ②, ④; [1]		
	(c)		Any **two** from: X produces more pressure/force; Pumps blood greater distance/all around the body; Y pumps blood to lungs; [2]		
	(d)		coronary **arteries**; [1]		
	(e)		Any **three** from: Heart **muscle**/**cells** receive **less** blood; less O_2/glucose; Stop respiring/producing energy; Die/stop contracting; [3]		
	(f)		**Stops pumping blood around the body**/circulation stops/no oxygen to cells; [1]		
	(g)		Any **three** from: 1. (The more exercise) the lower the heart rate; 2. (Heart rate decreases) from 80 to 60 beats per min; 3. The more exercise the more blood pumped **per beat**; 4. (Volume of blood pumped per beat increases) from 60 cm^3 to 90 cm^3; 5. Strengthens (heart muscles); [3]		12

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				AVAILABLE MARKS
8	**(a)**	Less haemoglobin/fewer red blood cells; (Less) oxygen transported (to body/cells); (Less) respiration/energy produced;	[3]	
	(b)	Heart rate increases/rapid; More blood has to be pumped to the cells;	[2]	
	(c)	Pale skin;	[1]	
	(d)	Blood/parts of blood (from a different person) added to the bloodstream/ body;	[1]	
	(e)	iron (tablets);	[1]	8
9	**(a)**	1 – ovulation; 3 – mitosis/cell division;	[2]	
	(b)	2 – fertilisation; sperm and ovum **nuclei fuse**; 4 – implantation; foetus “sinks” into **uterus lining**;	[2] [2]	
	(c)	Large surface area; increase (rate of) diffusion (of glucose/oxygen); **or** thin membranes; short diffusion distance; **or** good blood supply; maintains high concentration/diffusion gradient;	[2]	8
10	**(a)**	**(i)** Range (several types) of a trait/characteristic in a **population/species**; (Coat) colour (in the mouse);	[2]	
		(ii) In dark areas dark fur provides **camouflage/better adapted**; This provides a (selective) advantage against **predation**; Individuals with advantage are more likely to **survive**/reproduce; **pass genes** on (to next generation); Individuals with the advantage (/described) **increase in numbers**; **or** without the advantage (/described) decrease in number/become extinct; **Any four**	[4]	
	(b)	(Natural selection causes gradual) changes in a genotype of a population/ species; over a (long) period of time/many generations;	[2]	8

					AVAILABLE MARKS
11	**(a)**	**(i)**	artificial;	[1]	
		(ii)	Any **four** from: Vaccine contains dead/weakened disease-causing organism; Which doesn't cause the disease; but contains antigens; stimulates white blood cells/lymphocytes; To produce antibodies; Memory cells;	[4]	
		(iii)	Passive – body **receives** ready-made antibodies/doesn't make own antibodies	[1]	
	(b)	**(i)**	Have received passive immunity/antibodies from their mother remain in their blood;	[1]	
		(ii)	550 – 70; = 480; thousand;	[3]	
		(iii)	vaccination introduced (1968/9);	[1]	
		(iv)	85 < 94%	[1]	12
12	Any **two** pairs: Technique: flaming loop/sterilising loop (in alcohol)/flaming neck of (culture) bottle; Explanation: (Heat/alcohol) kills bacteria; Technique: open lid of Petri dish/culture bottle 45 °; Explanation: Prevents entry/contamination of bacteria; Technique: work near a (lit) Bunsen; Explanation: heat carries microorganisms upwards; Technique: seal Petri dishes; Explanation: prevents microorganism/pathogens **escaping**;			[4]	4
13	**(a)**		bacteria **not killed** by an antibiotic; Not ref to immune	[1]	
	(b)		fungus;	[1]	
	(c)		oxacillin;	[1]	
	(d)		CA – Gentamicin; [1] HA – Tetracycline; [1] Correct percentage of bacteria killed from graph – 94% gentamicin/ 93% tetracycline; [1]	[3]	
	(e)	**(i)**	mutant bacteria survive/reproduce; therefore pass on resistance gene/chromosome/mutation;	[2]	
		(ii)	Any **two** from: patients may have open wounds; weakened immune systems; be in close proximity to other infected person; hospitals are an antibiotic environment;	[2]	
		(iii)	bacteria will not yet have developed resistance to new antibiotic/ resistant bacteria will be killed by new antibiotic;	[1]	11

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14 Indicative content:

1 Tissue fluid formed by (high) pressure in blood;
2 Pushes/forces plasma (/water and dissolved substances);
3 Through thin/leaky capillary walls;
4 Into spaces between the cells;
5 Some/re-enters the blood/capillary;
6 By diffusion/osmosis;
7 Remaining fluid drains into the lymph vessel;
8 Returned to blood system;
9 The same volume reabsorbed as formed;

Accept: bullet points which start with capital letter.
Reject: through the capillary.

Response	Mark
Candidates must use appropriate, specialist terms throughout to describe and explain the formation of lymph **using at least 6 of the above points.** They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some appropriate, specialist terms throughout to describe and explain the formation of lymph **using at least 4 of the above points.** They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates make little use of specialist terms throughout to describe and explain the formation of lymph **using at least 2 of the above points.** The spelling, punctuation and grammar, form and style are of a limited standard.	[1]–[2]
Response not worthy of credit.	[0]

[6] 6

Total **115**

AVAILABLE MARKS

Rewarding Learning

General Certificate of Secondary Education
2014

GCSE Biology

Unit 2

Higher Tier

[GBY22]

MONDAY 16 JUNE, MORNING

MARK SCHEME

STEMUP.CO.UK

General Marking Instructions

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					AVAILABLE MARKS
1	**(a)**	Similarity – Both have genetic material;	[1]		
		Difference – Any **one** from: TB has double stranded genetic material, HIV single stranded; TB has cell wall, HIV has protein layers; TB has plasmids, HIV does not;	[1]		
	(b)	Droplets in saliva by **coughing/sneezing**;	[1]		
	(c)	Spread – Sexual **intercourse**/blood to blood contact [described];	[1]		
		Prevented – Condom/abstinence/screening blood;	[1]		5
2	**(a)**	**(i)** Similarity – [AGE] Death from CHD increases with age;	[1]		
		Difference – [GENDER] More men than women die from CHD;	[1]		
		(ii) More women in population/lower population;	[1]		
	(b)	Don't smoke (cigarettes); exercise (regularly); avoid stress; **Reduce** salt/sugar/fat/cholesterol/alcohol; (Any **two**)	[2]		5
3	**(a)**	Any **three** Use quadrats/Random sampling; Weigh fruits; Record on table/tally chart;	[3]		
	(b)	**(i)** **Continuous** (variation);	[1]		
		(ii) Histogram;	[1]		
	(c)	Any **one** Most strawberries between 10.0 and 11.9; Data/range described;	[1]		6
4	**(a)**	**(i)** Cell vacuole/nuclear **membrane**;	[1]		
		(ii) Lets water/some/certain/small substances to pass through;	[1]		
	(b)	**(i)** Nucleus correct shape and position; Smaller vacuole; Cell membrane away from cell wall;	[3]		
		(ii) Plasmolysed/plasmolysis;	[1]		6

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		AVAILABLE MARKS
5	**Indicative content:** 1 Blood flow to heart increased 3 times/from 250 to 750; 2 (Heart increases) to pump blood; 3 Blood to muscles increases × 10/from 1200 to 12 000; 4 More oxygen/glucose/sugar needed for respiration/energy; 5 Blood flow skin increases 500 to 2000/intestines decreases 3100 to 1500; 6 Because blood diverted towards/away from (named organ); **Or** 7 Total blood flow increases from 5050 to 16 250; 8 Due to increased cardiac output;	

Response	Marks
Candidates **must use appropriate, specialist terms throughout** to describe and explain the effect of exercise on blood flow **using at least FIVE of the points above**. They use **good** spelling, punctuation and grammar and the form and style are of a **high** standard.	[5]–[6]
Candidates use **some appropriate, specialist terms throughout** to describe and explain the effect of exercise on blood flow **using at least THREE of the points above**. They use **satisfactory** spelling, punctuation and grammar and the form and style are of a **satisfactory** standard.	[3]–[4]
Candidates **make little use of specialist terms throughout** to describe and explain the effect of exercise on blood flow **using at least ONE of the above points**. The spelling, punctuation and grammar, form and style are of a **limited** standard.	[1]–[2]
Response not worthy of credit	[0]

[6] 6

6 **(a)** Patch must be homozygous recessive/hh;
Patch **must get** recessive allele from **each** parent;
But each parent suffers so **must also have dominant allele/H**; [3]

(b) Test cross;
With normal/double recessive/hh/Patch;
Willow is either homozygous dominant/HH or heterozygous/Hh;
If Willow homozygous offspring all suffer from PKD;
If Willow is heterozygous/Hh,
Some offspring will be normal; [5] 8

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					AVAILABLE MARKS
7	**(a)**	**(i)**	Down syndrome;	[1]	
		(ii)	Extra chromosome; chromosome 21;	[2]	
		(iii)	23 pairs of chromosomes;	[1]	
		(iv)	(X and Y) chromosomes present;	[1]	
	(b)	**(i)**	Amniotic fluid;	[1]	
		(ii)	Amniocentesis;	[1]	
		(iii)	Avoid damaging baby with syringe;	[1]	
		(iv)	Should mother have abortion if baby has condition; risk of miscarriage; free choice whether to screen or not; (Any **two**)	[2]	10
8	**(a)**	**(i)**	Antigen;	[1]	
		(ii)	Antibody–antigen reaction; clumping of the bacteria;	[2]	
	(b)	**(i)**	Memory cells produced;	[1]	
		(ii)	Secondary response (Antibody level) longer lasting; more antibodies produced;	[2]	
		(iii)	Primary antibody concentration starts to drop; Primary response antibody level below required for immunity/ converse for secondary;	[2]	
		(iv)	Expensive/time-consuming/some people don't go back for second injection/can catch disease between injections;	[1]	
		(v)	So bacteria cannot cause disease; still triggers antibody/memory cells/production;	[2]	
		(vi)	Artificial/active;	[1]	12
9	**(a)**		Any **two** from: Thin **walls**/one cell thick; Permeable walls; High pressure;	[2]	
	(b)		Carbon dioxide/urea/water;	[1]	
	(c)		Lymph; Returned to bloodstream;	[2]	5

				AVAILABLE MARKS
10	**(a)**	Any **four** Diameter decreases/cell shrunk; lost water; by osmosis; from dilute to concentrated solution/more water inside cell/concentration gradient described; through a selectively permeable membrane;	[4]	
	(b)	Any **four** No change in diameter of red blood cell in solution B; (B) Concentration inside and outside cell equal/isotonic; Water neither enters nor leaves cell; Water enters red blood cells in solution C; Cells burst/lyse;	[4]	8
11	**(a)**	Sugar; phosphate;	[2]	
	(b)	**(i)** Same A as T; Same G as C; More A–T than G–C; A greatest/C lowest; Other appropriate response; (Any **three**)	[3]	
		(ii) 100 – 42; 58 ÷ 2 = 29;	[2]	
	(c)	Franklin and Wilkins; Watson and Crick; Franklin and Wilkins took X-ray photos; Watson and Crick made models;	[4]	11
12	**(a)**	**(i)** A – red blood cell;	[1]	
		B – white blood cell;	[1]	
		(ii) Transport oxygen;	[1]	
		(iii) Biconcave (shape/disc); Large surface area/faster gas exchange;	[2]	
		(iv) Fibrinogen; changed to fibrin; (Fibrin) mesh traps red blood cells;	[3]	
	(b)	**(i)** Iron;	[1]	
		(ii) Less haemoglobin; to carry oxygen; for respiration;	[3]	
	(c)	**(i)** Platelets;	[1]	
		(ii) Plasma;	[1]	
		(iii) Group AB has smallest stock level; but lasts the greatest number of days; AB must be small proportion of population/rare blood group;	[3]	17

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13 (a) (i) Fleming; [1]

(ii) Fungus/mould; [1]

(iii) Isolated a pure/powder form (of penicillin);
(Helped to) develop large scale/industrial production; [2]

(b) Indicative content:

1 Antibiotic (A) kills most of the bacteria;
2 Bacteria that survive have a **mutation**;
3 Makes them **resistant** to antibiotic A;
4 Resistant/surviving bacteria reproduce;
5 Resistant gene passed on to offspring;
6 making **whole colony resistant**;
7 Those that survive treatment with antibiotic **B** are resistant to both;
8 Superbugs have resistance to several antibiotics;

Response	Mark
Candidates **must use appropriate, specialist terms throughout using at least FIVE of the above points**. They use **good** spelling, punctuation and grammar and the form and style are of a **high standard**.	[5]–[6]
Candidates use **some appropriate, specialist terms** throughout **using at least THREE of the above points**. They use **satisfactory** spelling, punctuation and grammar and the form and style are of a **satisfactory** standard.	[3]–[4]
Candidates make **little use of specialist terms** throughout **using at least ONE of the above points**. The spelling, punctuation and grammar, form and style are of a **limited** standard.	[1]–[2]
Response not worthy of credit.	[0]

[6]

(c) (i) Deaths increase until **2008**/highest at **2008**;
Reduce/decline/fall/go down; [2]

(ii) More frequent use of antibiotics;
new strains of bacteria present; [1]

(iii) Any **three** from:
Washing hands/using alcohol hand gel;
Intensive cleaning/sterilising of equipment;
Using disposable/freshly laundered (sterilised) clothing;
Restricted use of antibiotics;
Isolation of infected patients; [3]

Total

AVAILABLE MARKS

16

115

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2013

Biology

Unit 2

Higher Tier

[GBY22]

GBY22

TUESDAY 18 JUNE, MORNING

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided.
You must answer the questions in the spaces provided. Do not write outside the box, around each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all thirteen** questions.

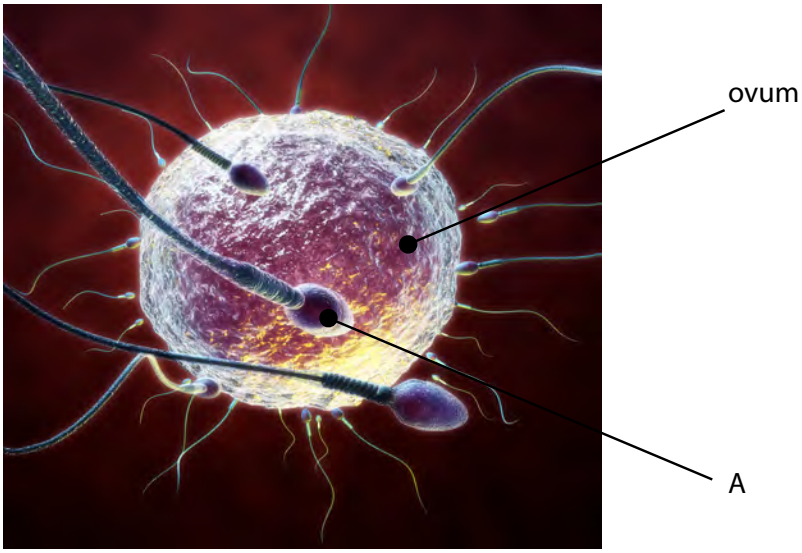
INFORMATION FOR CANDIDATES

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**, **8(c)** and **13(c)**.

8270

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1 The photograph shows sperm swimming towards an ovum.



© Medi-mation / Science Photo Library

(a) (i) Name part **A** of the sperm.

_____ [1]

(ii) Describe **one** way part **A** is adapted to its function.

_____

_____ [1]

(iii) Give **one other** way the sperm is adapted to its function.

_____ [1]

(iv) Suggest **one** reason why all the sperm do not appear to be the same size.

_____

_____ [1]

(b) Name the cell produced by fertilisation.

_____ [1]

Examiner Only	
Marks	Remark
Total Question 1	

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DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

[Turn over

Examiner Only	
Marks	Remark

2 **(a)** A ban on smoking in workplaces came into effect in the Republic of Ireland in 2004.

Bar staff completed a health questionnaire about their symptoms, before the ban and three years after the ban.

The table shows the results of the questionnaires.

Symptom	Percentage of bar staff complaining of symptoms	
	Before ban	3 years after ban
Eye irritation	82	51
Sneezing	75	34
Coughing	87	67

Adapted from: Respiratory health improvement continues after workplace smoking ban in Ireland by Michele Agnew, Patrick Goodman, Luke Clancy: Reproduced by permission of the European Respiratory Society Eur Respir J October 2008; 32, Suppl. 32: 259s (Abstract 1577) © European Respiratory Society

(i) Suggest **one** conclusion that can be made from the results of the questionnaires about the health of bar staff.

Use data from the table to support your conclusion.

_____

_____

_____

_____ [2]

(ii) Which symptom shows the greatest change after the ban?

_____ [1]

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(b) Give **one** reason why a ban on smoking in workplaces could benefit non-smokers.

_____

_____ [1]

(c) Suggest why some people are opposed to a ban on smoking in workplaces.

_____

_____ [1]

Examiner Only	
Marks	Remark
Total Question 2	

[Turn over

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3 Scientific method involves the following steps:
observation, making a hypothesis, experimentation, conclusion, validation.

Jenner is famous for having applied scientific method while developing vaccination as a way of preventing smallpox.

Some of the steps in Jenner's development of a smallpox vaccine were:

A Infect a person with cowpox. Then infect the person with smallpox.

B Jenner and other scientists repeated the procedure and got the same results.

C A person infected with cowpox may be protected from smallpox.

D Jenner heard dairymaids say "I shall never have smallpox for I have had cowpox".

(a) Which of the steps used by Jenner is an example of

observation? _____ [1]

validation? _____ [1]

(b) **Use the information given above** to help explain why Jenner's vaccination is an example of artificial, active immunity.

Artificial _____

_____ [1]

Active _____

_____ [1]

We now know that white blood cells, known as phagocytes, are important in protecting the body against diseases.

(c) Describe how phagocytes help protect against diseases.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 3	

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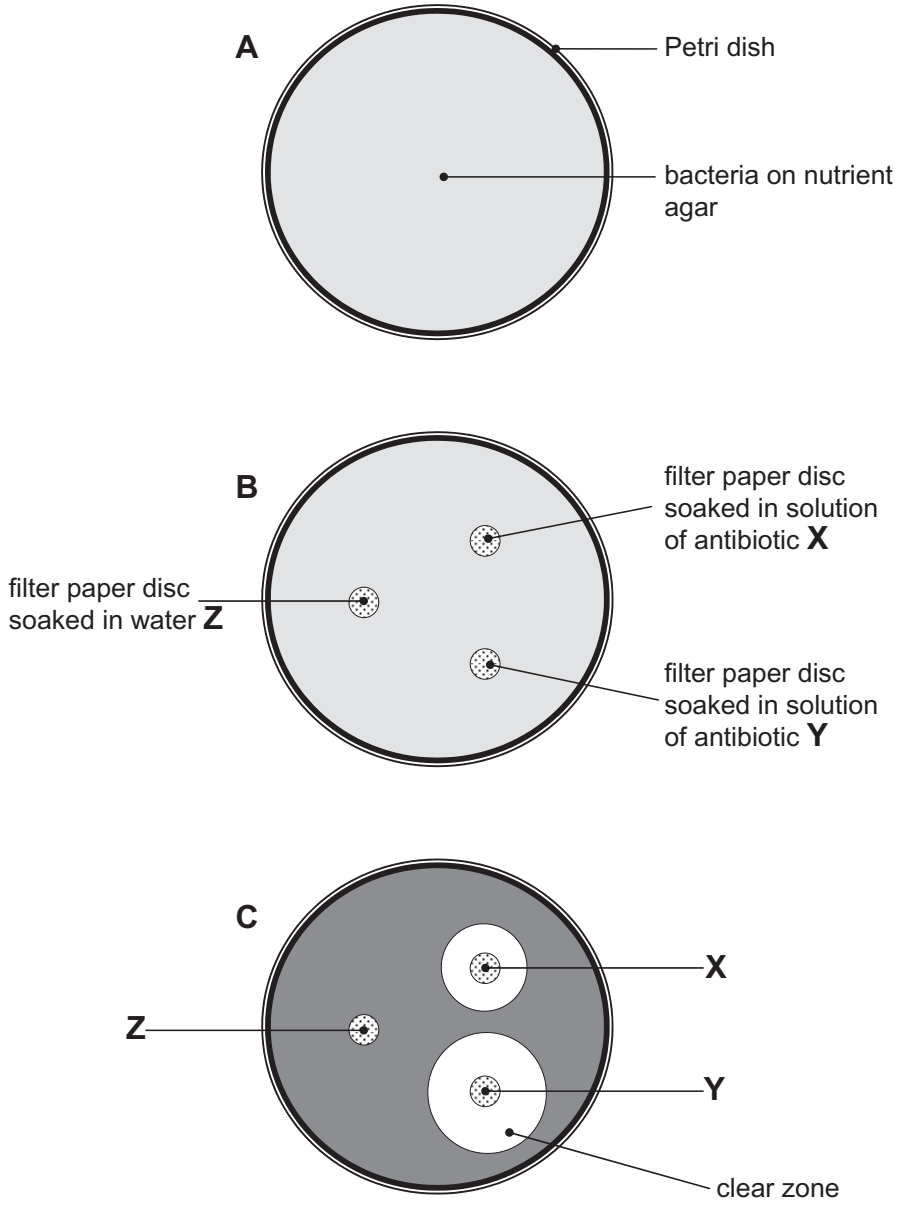
[Turn over

4 A student investigated the effect of two antibiotics **X** and **Y** on the growth of a bacterium.

Examiner Only	
Marks	Remark

She carried out the following procedure using aseptic techniques.

1. 1 ml of bacterial culture was added to a sterile Petri dish containing sterile nutrient agar as shown in diagram **A**.
2. Discs of filter paper were soaked in antibiotic solutions or water and placed on top of the nutrient agar. This is shown in diagram **B**.
3. The Petri dish was sealed, inverted and incubated at no more than 20°C for 48 hours. Diagram **C** shows the appearance of the Petri dish after this time.



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Use evidence from the diagram and the procedure to explain

- Which antibiotic was most effective
- How the experiment was a fair test
- The safety precautions needed.

In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

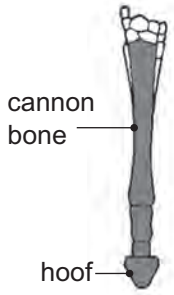
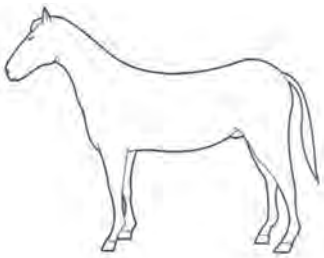
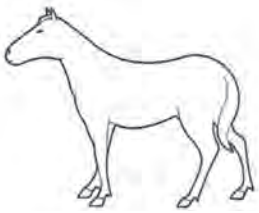
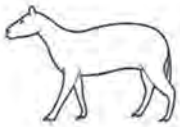
[6]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

5 The table shows some information, from fossil records, about the evolution of the horse.

Examiner Only	
Marks	Remark

Millions of years ago	Lower leg bones	Body	Height/m
1			1.6
10			1.0
40			0.6
60			0.4

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Using evidence from the table, describe the changes that appear to have happened to the horse over time.

_____

_____

_____

_____

_____ [4]

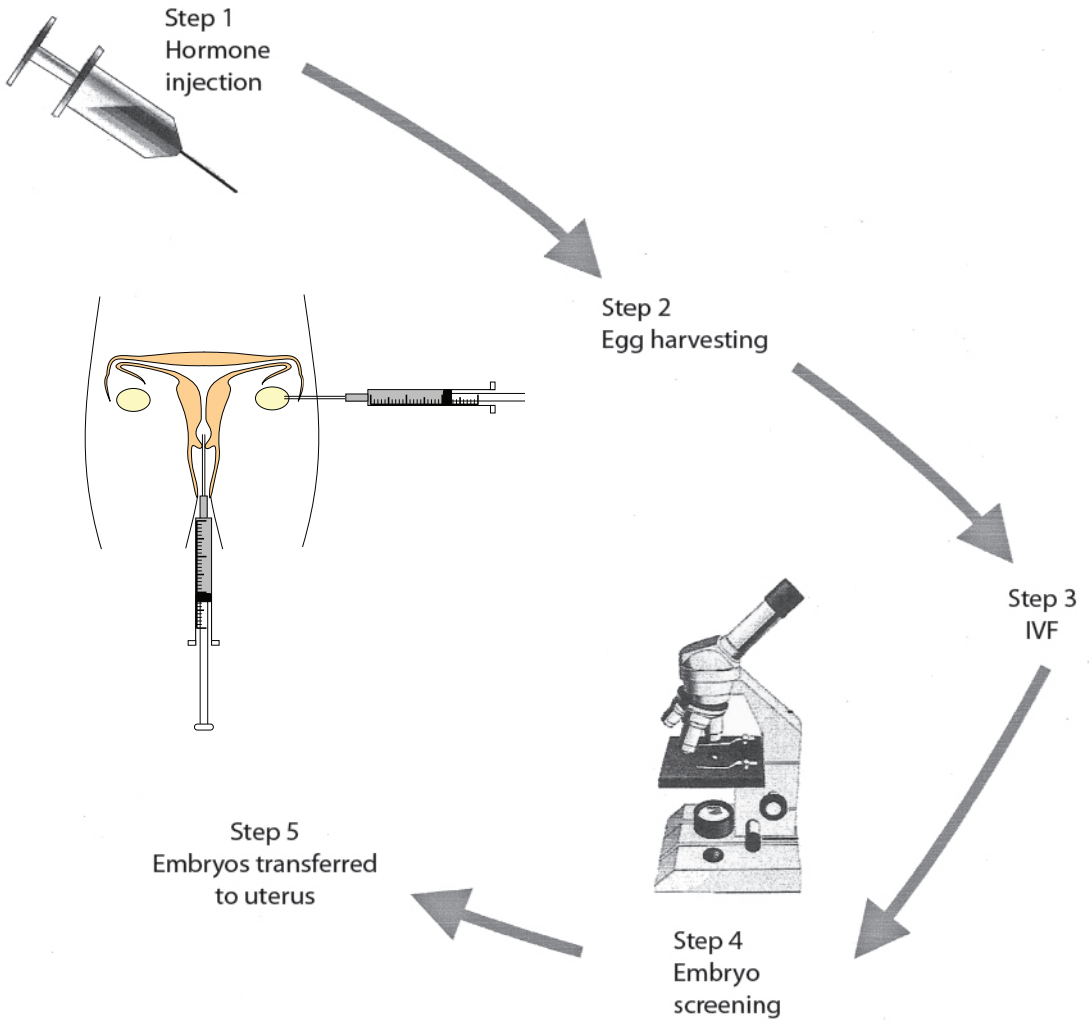
Examiner Only	
Marks	Remark
Total Question 5	

[Turn over

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Examiner Only	
Marks	Remark

6 The diagram shows the reproductive system from an infertile woman and summarises how *in vitro* fertilisation (IVF) can be used to overcome her infertility.



(a) **Use the diagram** to suggest the probable cause of infertility in this woman.

_____

_____ [1]

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During step 1 the woman receives a hormone injection.

(b) What effect does this injection have on the ovaries?

_____

_____ [1]

(c) Describe the process of *in vitro* fertilisation at step 3.

_____

_____

_____ [2]

(d) Suggest **two** reasons why the government introduced regulations which allow doctors to transfer only two embryos at step 5.

1. _____

_____ [1]

2. _____

_____ [1]

(e) Give **two** causes of infertility in males.

1. _____ [1]

2. _____ [1]

Examiner Only	
Marks	Remark
Total Question 6	

[Turn over

7 The table shows the results of an experiment carried out to investigate the effect of placing potato cylinders into a range of sugar solutions kept at the same temperature for 24 hours.
All the potato cylinders were taken from the same potato.

Concentration of sugar solution/M	Initial mass of potato cylinder/g	Final mass of potato cylinder/g	Change in mass of potato cylinder/g	Percentage change in mass of potato cylinder
0.0	4.00	4.80	+0.80	+20.0
0.2	4.28	4.75	+0.47	
0.4	3.95	4.03	+0.08	+2.0
0.6	4.00	3.72	−0.28	−7.0
0.9	4.20	3.36	−0.84	−20.0

(a) **Use the information given** to suggest **two** ways the experiment was a fair test.

_____

_____

_____ [2]

(b) **Complete the table** by calculating the percentage change in mass of the potato cylinder placed in 0.2 M solution.
Show your working.

[2]

Examiner Only

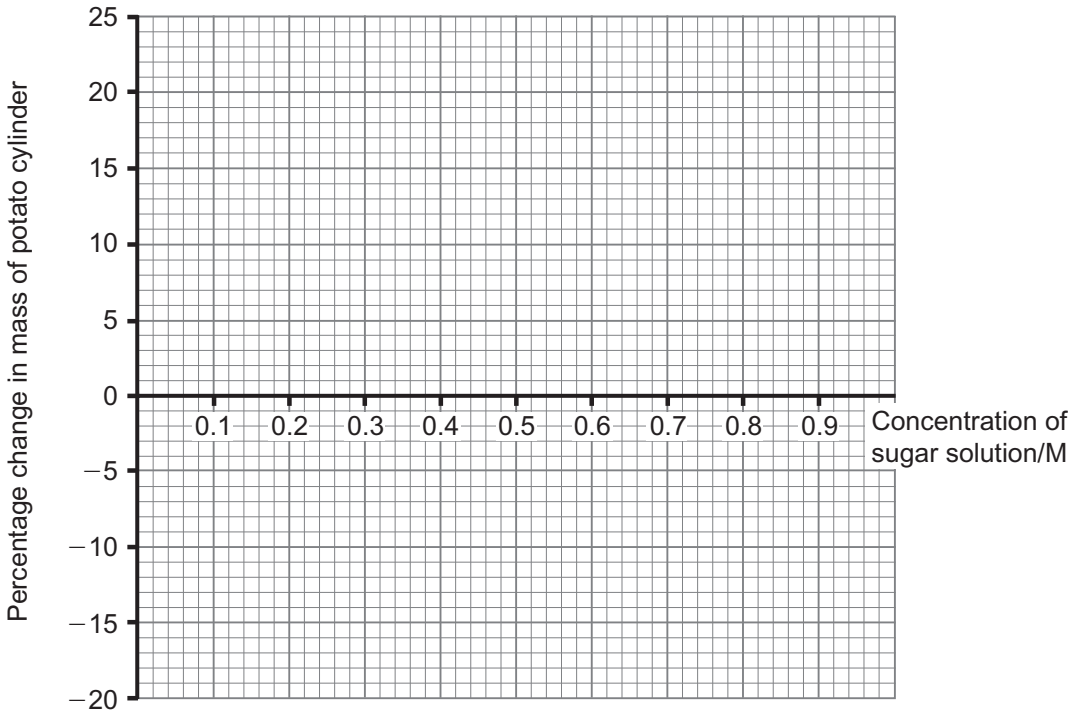
Marks	Remark

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(c) Explain the percentage change in mass of the potato cylinder placed in 0.6 M solution.

[3]

(d) Draw a line graph of these results on the grid provided.



[3]

Examiner Only	
Marks	Remark

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(e) **Use the graph** to find the concentration of sugar solution which is equal to the concentration of the cytoplasm in potato cells.

Explain your answer.

Concentration _____ M

Explanation _____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 7	

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(Questions continue overleaf)

[Turn over

8 The table shows the percentage of adults who have a high concentration of cholesterol in their blood.

Year	Percentage of adults who have a high concentration of cholesterol in their blood	
	Men	Women
1998	75	77
2005	58	61

Adapted from: www.heartstats.org

(a) Describe **one** trend shown in the table.

_____

_____

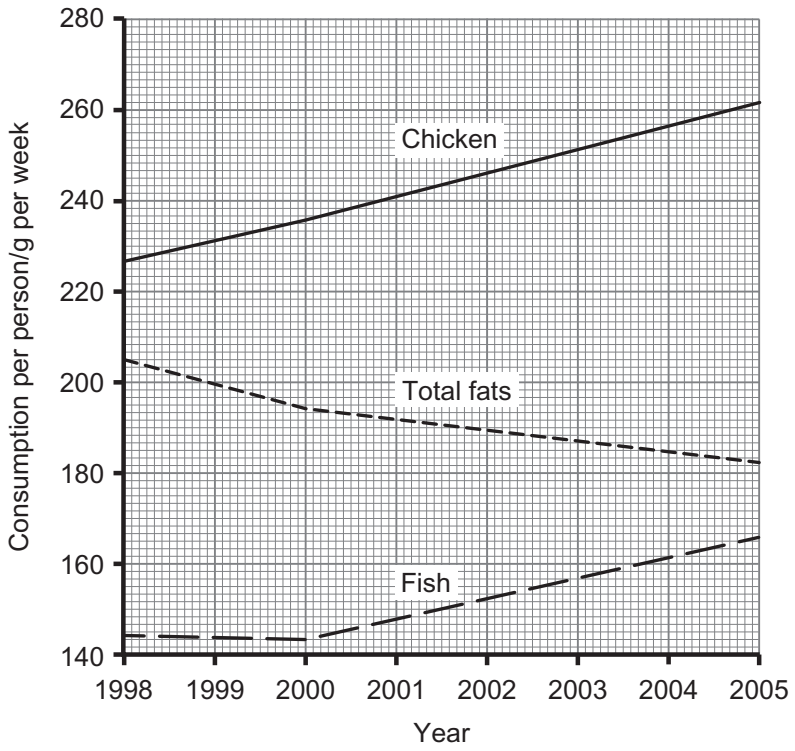
_____ [1]

Examiner Only	
Marks	Remark

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One of the factors causing high cholesterol in blood is the fat in a person's diet.

The graph shows the consumption of fish, chicken and total fats between 1998 and 2005 by adults.



Source: www.heartstats.org

(b) Use data from the graph and the table to help explain why the percentage of adults who have a high concentration of cholesterol in their blood has changed between 1998 and 2005.

[4]

Examiner Only

Marks	Remark

[Turn over

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(c) The diagram shows how cholesterol can build up in an artery wall when the concentration of cholesterol in the blood is high.

Examiner Only	
Marks	Remark

diagram removed for copyright reasons

Compare and contrast the effect on the heart of a build up of cholesterol in a coronary artery wall with the effect on the brain of a build up of cholesterol in an artery wall.

In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

[6]

Total Question 8

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9 **(a)** Name the chamber of the heart which

receives deoxygenated blood from the vena cava.

_____ [1]

pumps oxygenated blood into the aorta.

_____ [1]

(b) Explain the role of the valve between the heart and the pulmonary artery.

_____

_____

_____ [2]

(c) Name the blood vessel which returns blood from the brain to the heart.

_____ [1]

Examiner Only	
Marks	Remark
Total Question 9	

[Turn over

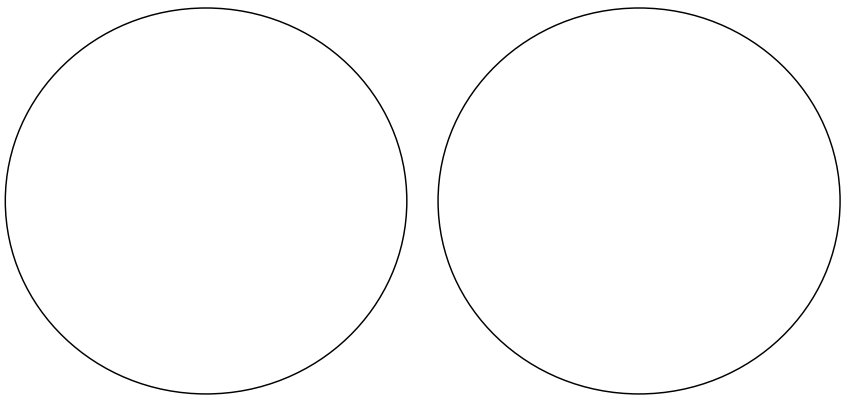
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10 (a) The diagram shows chromosomes during cell division.

Examiner Only	
Marks	Remark



(i) **Complete the diagrams** below by drawing the chromosomes of the daughter cells that would be produced when this cell divided by mitosis.



[2]

Mitosis is used in asexual reproduction and cloning.

(ii) Give **two** other ways mitosis is used in living organisms.

1. _____

_____ [1]

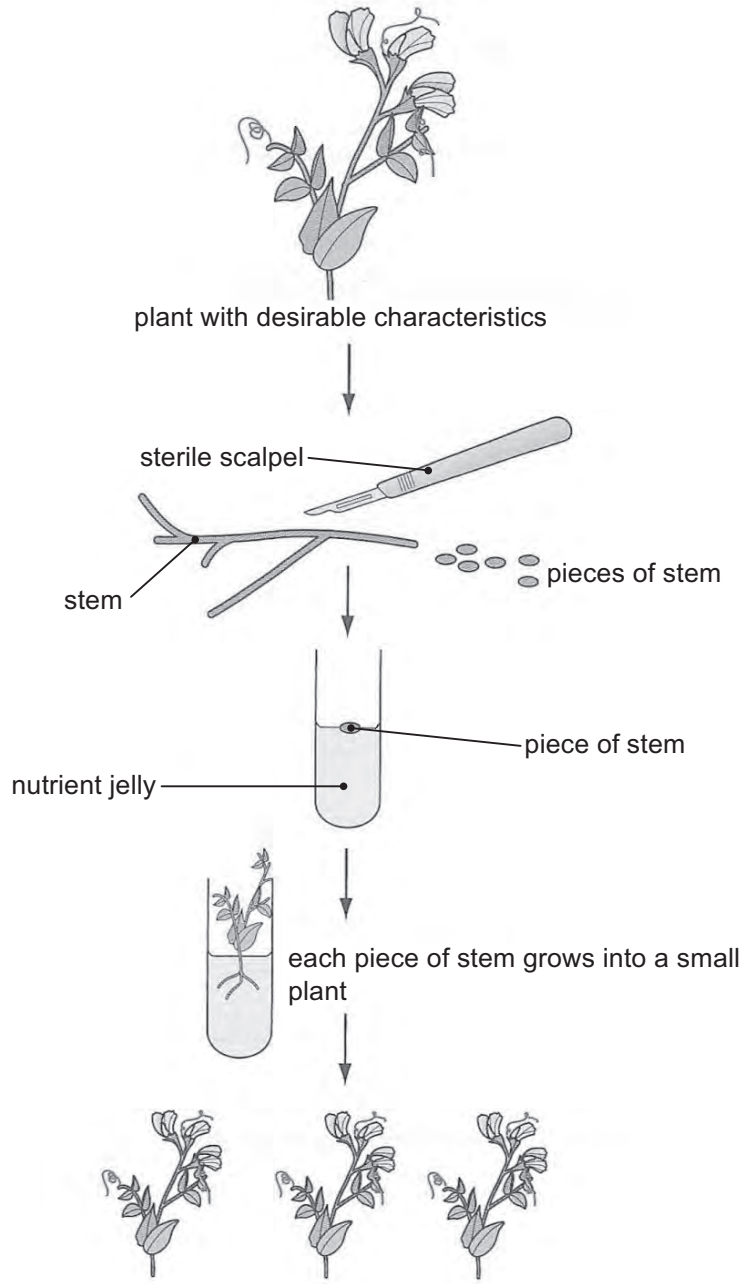
2. _____

_____ [1]

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(b) The diagram shows some steps involved in cloning plants.

Examiner Only	
Marks	Remark



© *Barking Dog Art*

(i) Suggest why the scalpel used to cut the pieces of plant stem must be sterile.

_____

_____ [1]

[Turn over

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(ii) Why are the plants produced in this process called clones?

_____

_____ [1]

(iii) Give **one** advantage and **one** disadvantage of cloning plants in this way.

Advantage _____

_____ [1]

Disadvantage _____

_____ [1]

Examiner Only	
Marks	Remark
Total Question 10	

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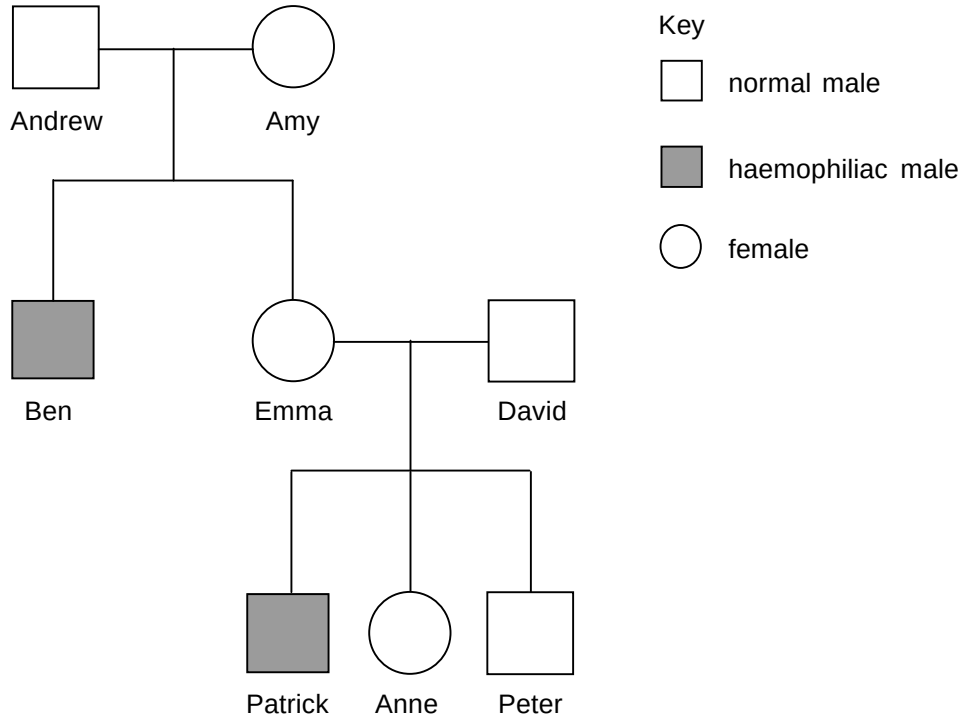
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(Questions continue overleaf)

[Turn over

11 Haemophilia is a recessive sex-linked inherited disorder.

The diagram shows a family tree.



Use the following symbols to help answer the questions.

X^H for the normal allele.

X^h for the recessive haemophiliac allele.

(a) **Use evidence from the diagram** to explain why Amy must be a carrier of haemophilia.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

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(b) Explain using the Punnett square, the genotypes and phenotypes of each of Emma and David's children.

		David's gametes	
Emma's gametes			

[4]

Phenotypes

Patrick _____ [1]

Peter _____ [1]

Anne _____

_____ [2]

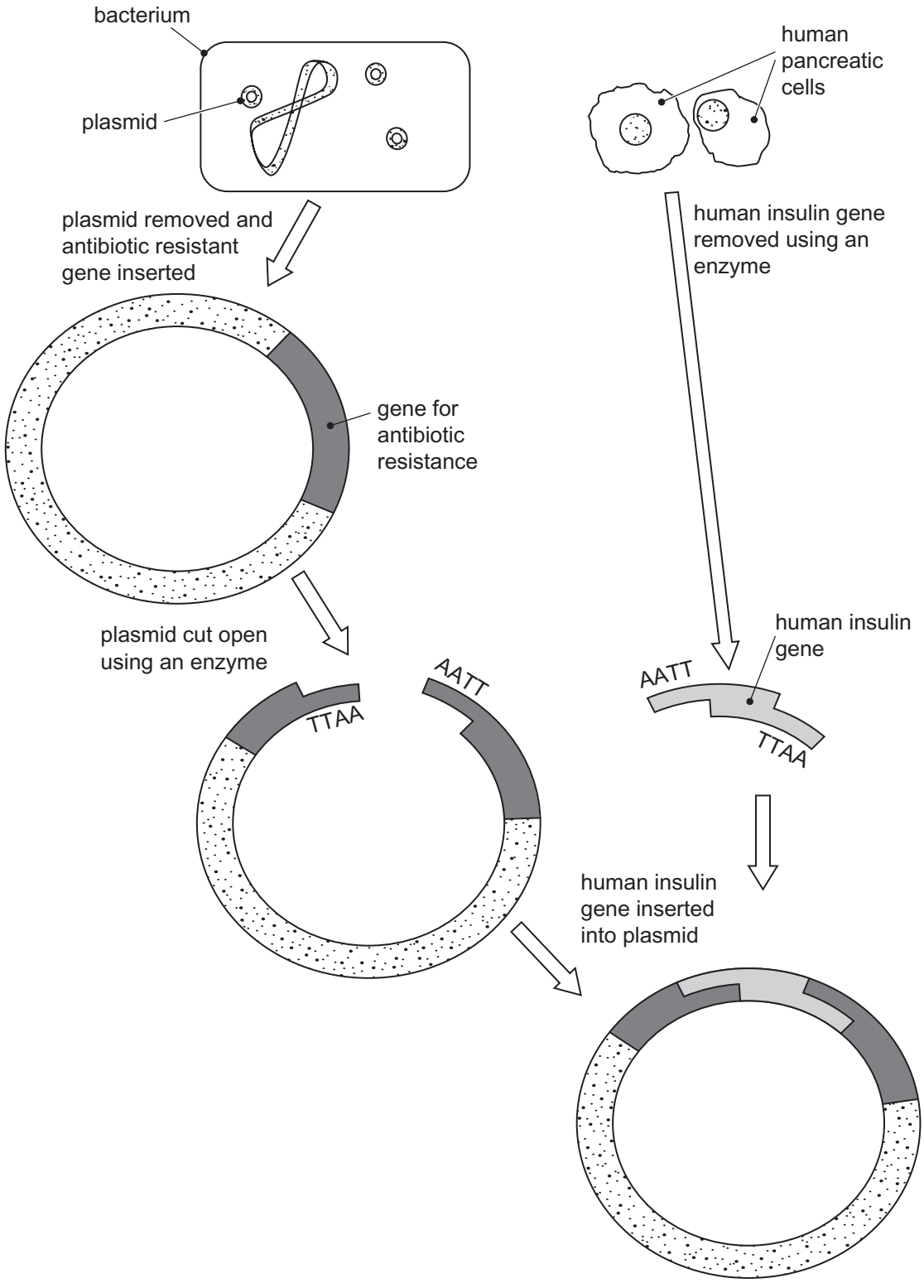
Examiner Only	
Marks	Remark
Total Question 11	

[Turn over

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12 The diagram shows some of the steps involved in the production of a genetically modified bacterium containing the human insulin gene.

Examiner Only	
Marks	Remark



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

_____ [1]

(b) **Use the information in the diagram** to explain why it is important to use the same enzyme to cut out the insulin gene and cut open the plasmid.

_____

_____

_____

_____ [2]

(c) What could you conclude if, after this process, the antibiotic-resistant gene in the plasmid remained intact?

_____

_____ [1]

The plasmid with the human insulin gene inserted is then placed into a bacterium.

(d) Describe the next stages involved in the production of insulin in an industrial fermenter.

_____

_____

_____

_____

_____ [4]

Examiner Only	
Marks	Remark

[Turn over

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(e) Give **three** stages involved in downstream processing once the insulin has been produced in the fermenter.

_____

_____

_____

_____ [3]

Before genetically engineered human insulin was available, people with diabetes used animal insulin.

(f) Give two advantages of using genetically engineered human insulin rather than animal insulin.

1. _____

_____

2. _____

_____ [2]

(g) Suggest **two other** factors which scientists have to take into consideration when making decisions about implementing new scientific techniques.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 12	

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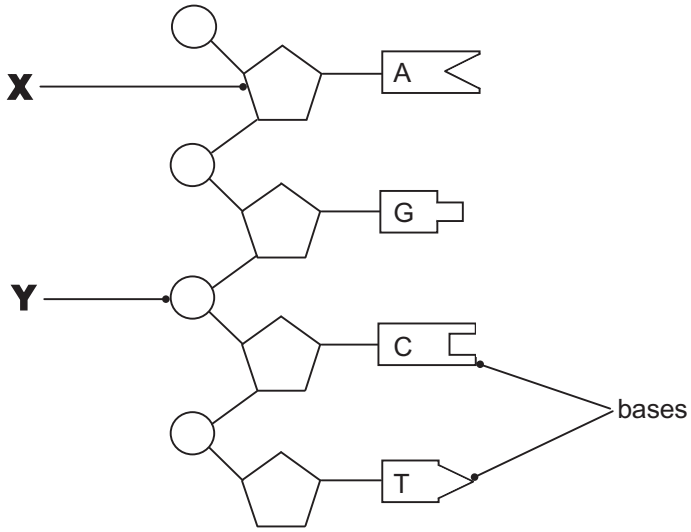
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[Turn over

13 The diagram shows part of a strand of DNA.

Examiner Only	
Marks	Remark



(a) Name the chemicals **X** and **Y**.

X _____ [1]

Y _____ [1]

(b) What term is used to describe the three-dimensional shape of a DNA molecule?

_____ [1]

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(c) Describe how using different lines of evidence led scientists to the discovery of the structure of DNA.

In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

(d) The results of research into the percentage of each of the bases present in the DNA of five people are shown in the table.

Person	Percentage of base in DNA			
	A	T	G	C
1	30.9	29.7	19.9	20.1
2	28.9	29.8	22.4	19.5
3	29.2	29.6	19.1	21.3
4	29.7	30.1	21.2	21.0
5	28.3	29.3	20.4	19.6
Average	29.4	29.7	20.6	

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Examiner Only	
Marks	Remark

(i) **Complete the table** by calculating the average percentage of the base **C**. [1]

(ii) Suggest why the results for each base are considered to be reliable.

_____

_____ [1]

(iii) What **two conclusions** can be made from these results about the percentage of the bases present in these samples of DNA?

1. _____

_____

_____ [1]

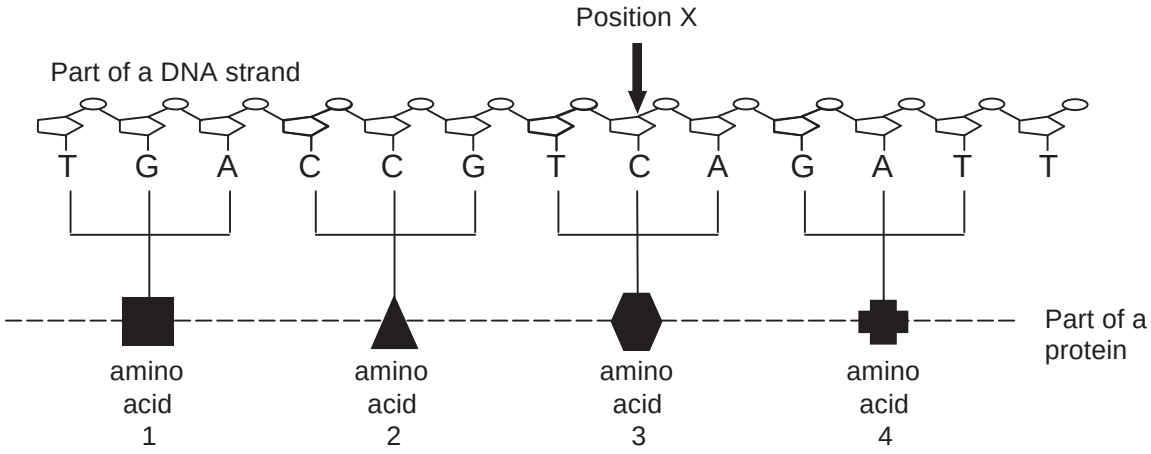
2. _____

_____

_____ [1]

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(e) The diagram shows how the bases on part of a DNA strand are used as a code.



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(i) Explain the effect of a random change in the DNA molecule at position X from base C to G.

_____

_____

_____ [2]

(ii) What name is given to such a change in the DNA molecule?

_____ [1]

(iii) Give the cause and effect of such a change in the DNA of skin cells.

Cause _____ [1]

Effect _____ [1]

Examiner Only	
Marks	Remark

[Turn over

(iv) Suggest **two** possible consequences of a random change in the DNA molecule during meiosis.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 13	

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Question Number	**Marks**
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Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2013

Biology

Unit 2

Higher Tier

[GBY22]

TUESDAY 18 JUNE, MORNING

MARK SCHEME

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General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	**(a)**	**(i)**	Head/nucleus;	[1]	
		(ii)	Contains half the number of chromosomes/haploid; **Accept**: Contains enzymes to help entry into egg	[1]	
		(iii)	Tail/flagellum;	[1]	
		(iv)	Some are further away (from camera) than others/reference to 3D image;	[1]	
	(b)		Zygote;	[1]	5
2	**(a)**	**(i)**	Bar workers' respiratory health has improved; Any **one** from: Eye irritation from 82% to 51%/31% less; Sneezing from 75% to 34%/41% less; Coughing from 87% to 67%/20% less;	[2]	
		(ii)	Sneezing;	[1]	
	(b)		Reduces passive smoking/the amount of smoke in the air they are forced to breathe in;	[1]	
	(c)		Freedom of choice/rights of the smoker/fall in revenue;	[1]	5
3	**(a)**		D; B;	[1] [1]	
	(b)		**Artificial** – Injected/infected by man/Jenner; **Active** – body/patient/person (who is being vaccinated) **produces own antibodies**;	[1] [1]	
	(c)		Engulf bacteria/viruses; Digest bacteria/viruses;	[2]	6

4 **Indicative content:**

Maximum of **two** from points 1, 2, 3.

1 **Y**;

2 Larger (diameter of) clear zone/correct (comparative) measurement of **Y** clear zone (diameter);

3 More **bacteria** are killed/affected/the less resistant the bacterium is to the antibiotic;

Maximum of **two** from points 4, 5, 6 in context of fair test.

4 Water is control/for comparison with the antibiotic solutions;

5 Concentration of antibiotic solution/size of filter paper/incubation time/ nutrient agar/type or amount of bacteria/temperature (kept constant [controlled/same]);

6 Only one variable/changed/investigated;

Maximum of **two** from points 7, 8, 9 in context of safety precautions.

7 Incubated at 20 °C **or below**;

8 Seal plates/don't open plates;

9 Sterile [/sterilise] apparatus [/equipment/agar]/aseptic techniques described;

Response	**Marks**
Candidates must use appropriate, specialist terms throughout to explain which of the bacteria is least affected **using at least FIVE of the points above.** They use **good** spelling, punctuation and grammar and the form and style are of a **high** standard.	[5]–[6]
Candidates **use some** appropriate, specialist terms throughout to explain which of the bacteria is least affected **using at LEAST THREE of the points above.** They use **satisfactory** spelling, punctuation and grammar and the form and style are of a **satisfactory** standard.	[3]–[4]
Candidates make **little use** of specialist terms throughout to explain which of the bacteria is least affected **using at LEAST ONE of the points above.** The spelling, punctuation and grammar, form and style are of a **limited** standard.	[1]–[2]
Response not worthy of credit	[0]

[6] 6

5 Any **four** from:

Animal taller;

Data reference years/height;

Neck/tail longer;

Longer legs/cannon bone;

4 toes to 1/middle toe larger/develops hoof; [4] 4

AVAILABLE MARKS

				AVAILABLE MARKS
6	**(a)**	Narrow/blocked oviducts;	[1]	
	(b)	Stimulates production (release) of multiple ova;	[1]	
	(c)	Ova and sperm are **mixed** in dish/test tube; **Nuclei** fuse;	[2]	
	(d)	Any **two** from: Reduced risk of multiple births/ More risk of babies dying (in multiple pregnancy)/reduce risk of premature birth; more risk of mother dying (in multiple pregnancy)/more difficult/stressful/ expensive for parents to bring up children from multiple births/more expense to NHS to care for multiple pregnancy; If it fails spare embryos are available;	[2]	
	(e)	Any **two** from: Low sperm count/no sperm produced/poor quality; Bacterial infection/blocked [twisted] sperm ducts [epididymis]/inflamed testes [Orchitis]; Impotence; Contact with dangerous chemicals/radiation/drug treatment/surgery;	[2]	8
7	**(a)**	Any **two** from: Same potato; Same temperature; Same time (in solution); Calculate **percentage change** (in mass);	[2]	
	(b)	[0.47 ×100] ÷ 4.28; = +11% [10.98%];	[2]	
	(c)	Any **three** from: Cylinder/potato loses weight [/mass]; Water leaves potato; Osmosis; Water diffuses from dilute solution to more concentrated solution, through the selectively permeable membrane;	[3]	
	(d)	Accurate plots [×2]; Line drawn;	[3]	
	(e)	0.44 (Accept 0.44–0.46); No (percentage) change in mass/no osmosis;	[2]	12

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AVAILABLE MARKS

8 **(a)** Any **one** from:
From 1998 to 2005 the percentage [of adults with high blood cholesterol] falls/higher percentage of women have high cholesterol; [1]

(b) Any **four** from:
Consumption of total fats falls; (total fats) from 204(±3)/to 182(±3)/ by 22(±6);
Fats high in cholesterol/increase concentration of cholesterol in blood;
Consumption of chicken/fish rises; (chicken) from 227(±3)/to 262(±3)/ 35(±6)/(fish) from 143(±3)/to 166(±3)/23(±6);
Chicken/fish **low** in cholesterol/fat; [4]

(c) **Indicative content:**
1 A build-up of cholesterol reduces/blocks/stops (blood flow);
2 [Both] reduce/stop transport of O_2/sugar/glucose;
3 Stops cell respiration/energy production;
4 Heart muscle/tissue cells die;
5 Causes heart attack;
6 Brain cells/tissue die;
7 Causes stroke;
8 Reduces brain function/coordination/example described;
9 Both can cause death;

Response	Marks
Candidates **must use** appropriate, specialist terms throughout to compare the effect of cholesterol build-up in arteries in the heart and brain **using at least 5 of the above points.** They use **good** spelling, punctuation and grammar and the form and style are of a **high standard**.	[5]–[6]
Candidates **use some** appropriate, specialist terms throughout to compare the effect of cholesterol build-up in arteries in the heart and brain **using at least 3 of the above points.** They use **good** spelling, punctuation and grammar and the form and style are of a **satisfactory standard**.	[3]–[4]
Candidates **make little use** of specialist terms throughout to compare the effect of cholesterol build-up in arteries in the heart and brain **using some or all of the above points.** The spelling, punctuation, grammar, form and style are of a **limited standard**.	[1]–[2]
Response not worthy of credit	[0]

[6] 11

					AVAILABLE MARKS
9	**(a)**	Right atrium;		[1]	
		Left ventricle;		[1]	
	(b)	Prevent backflow of blood;			
		into right ventricle;		[2]	
	(c)	Jugular vein;		[1]	5
10	**(a)**	**(i)**	Correct **number** of chromosomes;		
			Correct **shapes** of chromosomes;	[2]	
		(ii)	Growth;	[1]	
			Repair/replace worn out cells;	[1]	
	(b)	**(i)**	Prevent infection;	[1]	
		(ii)	Genetically identical;	[1]	
		(iii)	**Advantage**:		
			Cheap/Many plants produced (in short time);	[1]	
			Disadvantage:		
			Any **one** from:		
			Sterile/specialist equipment/specialist technicians required;		
			No variation/whole crop susceptible to same disease;	[1]	8
11	**(a)**	Ben/Patrick (haemophiliac) gets **Y** from his **father**/Andrew/David;			
		$\mathbf{X^h}$ from his mother/grandmother/Amy;		[2]	
	(b)	David's gametes $\mathbf{X^H}$, **Y**;			
		Emma's gametes $\mathbf{X^H}$, $\mathbf{X^h}$;			
		Offspring; Two lines of genotypes correctly filled in;		[4]	
		Phenotypes			
		Patrick – sufferer/haemophiliac;		[1]	
		Peter – normal;		[1]	
		Anne either carrier;			
		or normal;		[2]	10

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				AVAILABLE MARKS
12	**(a)**	Restriction;	[1]	
	(b)	Any **two** from: Will cut at same **sequence** of bases; Produces sticky ends; Gene and plasmid **complementary**; Base pairing can occur/described;	[2]	
	(c)	Insulin gene has not been taken up/inserted;	[1]	
	(d)	Nutrients/O_2 added; Bacteria reproduce; Form bacteria containing insulin gene; (Bacteria) produce human insulin;	[4]	
	(e)	Any **three** from: Extraction; Purification; Modification of insulin; Packaging;	[3]	
	(f)	**Advantage**: Any **two** from: No risk of transferring animal diseases; No harm to animals; No shortage/plentiful supply; No (allergic) reactions to GE insulin; Concentration/dosage known;	[2]	
	(g)	Any **two** from: Safety concerns to human; More expensive; More difficult to obtain/skilled workers required; Ethical concerns; Legislation considerations; Environmental issues;	[2]	15

AVAILABLE MARKS

13 **(a)** X – (deoxyribose) sugar; [1]
Y – Phosphate; [1]

(b) Double helix; [1]

(c) **Indicative content**:
1 Chargaff used chemical analysis;
2 showed base pairing/A = T/G = C;
3 Franklin/and Wilkins used X-ray (crystallography/diffraction);
4 to work out overall shape of DNA;
5 Crick and Watson used modelling;
6 to show the arrangement of bases/3D/helix/double strands;
7 Collaborative nature of science/research described;
Allow double helix only once;

Response	**Mark**
Candidates **must use** appropriate, specialist terms throughout to describe how using different lines of evidence led scientists to the discovery of the structure of DNA **using at least 5 of the above points.** They use **good** spelling, punctuation and grammar and the form and style are of a **high standard**.	[5]–[6]
Candidates **use some** appropriate, specialist terms throughout to describe how using different lines of evidence led scientists to the discovery of the structure of DNA **using at least 3 of the above points.** They use **good** spelling, punctuation and grammar and the form and style are of a **satisfactory standard**.	[3]–[4]
Candidates make **little use** of specialist terms throughout to describe how using different lines of evidence led scientists to the discovery of the structure of DNA **using some or all of the above points.** The spelling, punctuation, grammar, form and style are of a **limited standard**.	[1]–[2]
Response not worthy of credit.	[0]

[6]

(d) **(i)** 20.3; [1]

(ii) Five repeats/samples used; [1]

(iii) Any **two** from:
Most T;
Least C;
A/T greater than G/C;
A = T/C = G;
A + G = T + C/= 50%;
Each person has a similar proportion of bases; [2]

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				AVAILABLE MARKS
(e)	**(i)**	Any **two** from: (Amino acid 3) changes to amino acid 1; Produce a different protein; Protein may not function (in same way/properly);	[2]	
	(ii)	Mutation;	[1]	
	(iii)	**Cause** – Ultraviolet/UV light; **Effect** – (Skin) cancer;	[1] [1]	
	(iv)	Any **two** from: Occurs in production of sperm/egg cell/gamete; Inherited by/passed to next/following generations; Gamete may not grow/develop/fertilise/cause a **genetic** disorder;	[2]	20
			Total	**115**

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