CCEA GCSE DOUBLE AWARD SCIENCE

SCIENCE



EXAM QUESTION PACK

BIOLOGY UNIT B2 HIGHER TIER GSD42 PAPERS

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

GSD42

FRIDAY 10 JUNE, MORNING

TIME

1 hour 15 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 eleven** questions.

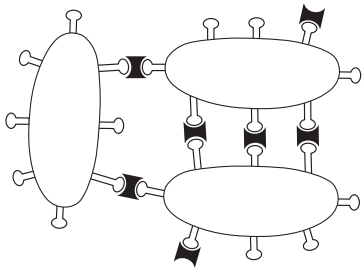
INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
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(b)** and **11(b)**.

10147

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1 **(a)** The body has a number of defence mechanisms against disease-causing microorganisms. One of these mechanisms is the clumping of microorganisms. The diagram shows a clump of three microorganisms.



Source: Principal Examiner

(i) On the diagram, label an antigen. [1]

(ii) Describe the stages that have occurred to produce this clump.

_____

_____

_____

_____

_____

_____ [3]

(iii) Microorganisms in a clump cannot easily move.
Suggest how this helps in the defence against disease.

_____ [1]

(b) After the clump has been formed it is then destroyed by another process.
Name and describe this process.

Name _____

Description _____

_____

_____

_____ [3]

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28GSD4202

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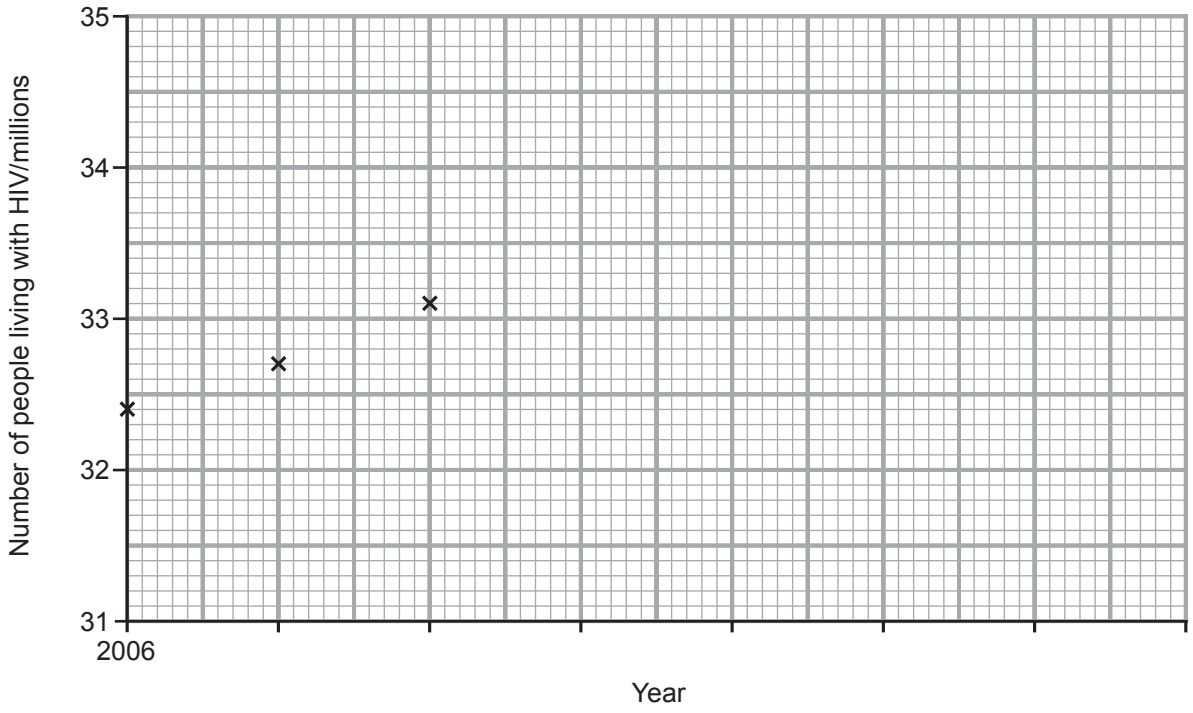
2 AIDS is a disease caused by the human immunodeficiency virus (HIV).
Table 1 shows worldwide data for HIV and AIDS for the years 2006 to 2013.

Table 1

	Number of people worldwide/millions							
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
People living with HIV	32.4	32.7	33.1	33.4	33.8	34.2	34.6	35.0
New HIV infections	2.8	2.7	2.6	2.5	2.5	2.4	2.2	2.1
AIDS related deaths	2.2	2.2	2.1	2.1	2.1	2.1	2.0	1.9
People receiving treatment				5.2	7.4	9.0	10.6	12.9

© UNAIDS, Global Report 2013, Fact Sheet

(a) (i) Use the data in **Table 1** to complete the line graph to show the number of **people living with HIV** for the years 2006 to 2013.
The first three points have been plotted for you.
Add the scale to the *x*-axis.



[4]

(ii) Describe the trend shown in the graph.

_____

_____ [1]

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Table 2 shows the amount of money spent on HIV and AIDS treatment and education for the same years.

Table 2	Year							
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Money spent/ billions of dollars	8.8	10.5	14.6	15.5	15.6	17.1	18.9	19.1

© UNAIDS, Global Report 2013, Fact Sheet

(b) The number of **AIDS related deaths** decreased from 2006 to 2013.

(i) Use the data in **Table 1 opposite**, to calculate the percentage decrease in **AIDS related deaths** from 2006 to 2013.

Show your working.

_____ % [2]

(ii) Use the data in the tables to give **two** reasons to explain this decrease in AIDS related deaths over this period.

1. _____

_____

2. _____

_____ [2]

(c) **(i)** Some other diseases caused by viruses can be prevented using vaccinations.
Name the scientist who developed the first vaccination.

_____ [1]

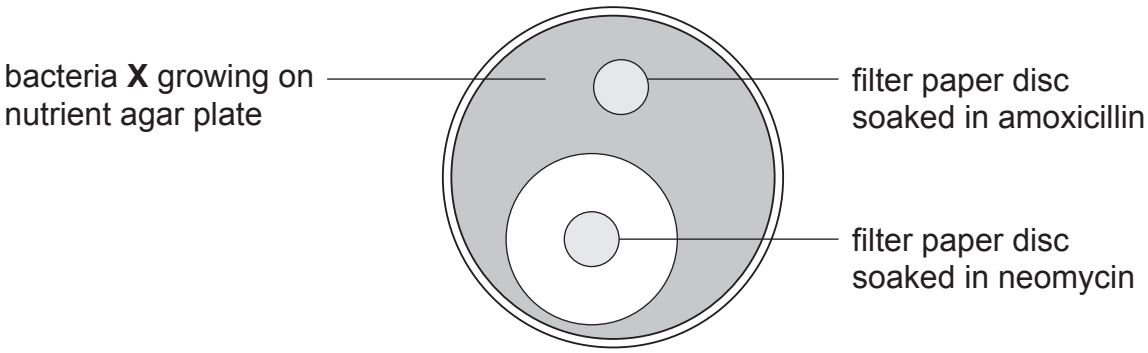
(ii) What disease was this vaccination used against?

_____ [1]

[Turn over

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3 Antibiotics are chemicals that are used to kill bacteria.
A nutrient agar plate had one type of bacteria (**X**) growing on the surface.
Two discs of filter paper, each soaked with a different antibiotic, were placed on the surface of the nutrient agar plate.
One disc of filter paper was soaked in amoxicillin and the other was soaked in neomycin.
The diagram shows the nutrient agar plate after it had been incubated for two days.



Use the diagram and your knowledge to describe and explain the effects of the antibiotics amoxicillin and neomycin on the growth of bacteria **X**.

Description _____

_____

_____

_____

Explanation _____

_____

_____

_____

_____

_____

_____ [4]

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4 Infertility in women can have several causes.

(a) Give **two** causes of infertility in women.

1. _____

_____

2. _____

_____ [2]

(b) In vitro fertilisation (IVF) can be used to treat infertility in some women. Describe the stages in the process of IVF.

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

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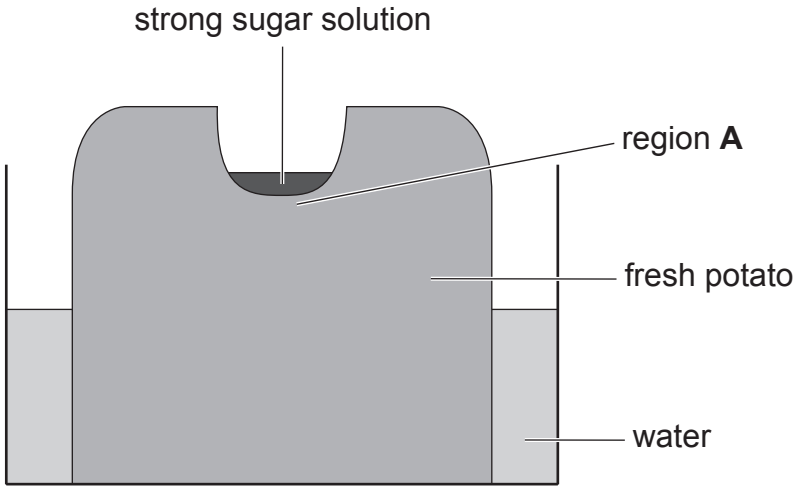
_____

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[6]

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5 Megan and Paul set up an experiment to investigate osmosis in a potato.
The diagram shows the levels of strong sugar solution and water at the start of the experiment.



The experiment was left for 4 hours.

(a) Describe what happened to the level of the strong solution after 4 hours.
Explain your answer.

Description _____

_____

Explanation _____

_____

_____

_____

_____ [3]

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(b) Describe how the vacuole and the cell membrane from a cell in region **A** will have changed after 4 hours, when the cell has become plasmolysed.

Vacuole _____

Cell membrane _____ [2]

[Turn over

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6 Peony plants have plain red or red striped flowers.
The photograph shows a red striped peony flower.



© Ian Gowland / Science Photo Library

In peony flowers the allele **R** for plain red colour is dominant.
The allele **r** for red striped flowers is recessive.

(a) A peony plant, homozygous for plain red flowers, is crossed with a heterozygous peony plant.
Draw a Punnett square to show the genotypes of the flowers that would be produced from this cross.

[4]

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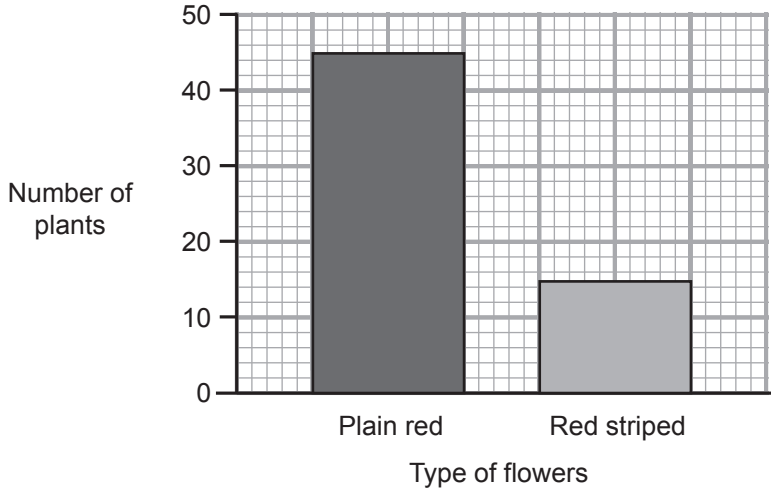
(b) A breeder has a peony plant with plain red flowers.
She is unsure of its genotype.
Draw Punnett squares to show how she could use a test (back) cross to find out the genotype of this plant.

[4]

[Turn over

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(c) Seeds were collected from another peony plant.
When plants were grown from these seeds the types of flowers produced were counted.
The bar graph shows the results.



(i) Use the graph to give the ratio of plain red flowers to red striped flowers produced from these seeds.

_____ to _____ [1]

(ii) Use the graph to give the type of variation shown by these flowers.

_____ [1]

(iii) Name a human characteristic that shows this type of variation.

_____ [1]

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7 Plants can be cloned using tissue culture.
The diagram shows how many new plants can be reproduced from small pieces of plant tissue.

Diagram removed due to copyright issues

(a) (i) Name the type of reproduction that involves cloning using tissue culture.

_____ [1]

(ii) What type of cell division does this reproduction involve?

_____ [1]

(b) Suggest **two** advantages of reproducing plants by this method.

_____

_____

_____ [2]

(c) A parent plant used in tissue culture was found to have a genetic disease.
Suggest why the plantlets from this plant could not be sold by a plant breeder.

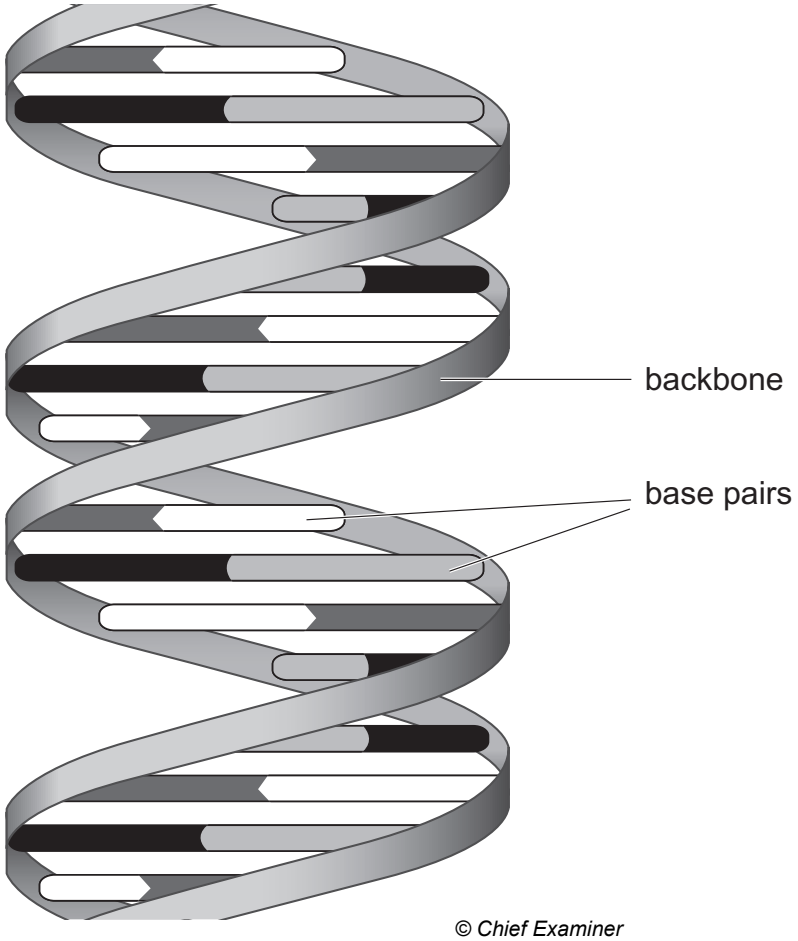
_____

_____ [1]

[Turn over

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8 Chromosomes are structures found in the nucleus of a cell.
Chromosomes are made of DNA.
The diagram shows a DNA molecule.



© Chief Examiner

(a) What term describes the shape of the DNA molecule?

_____ [1]

(b) Name the **two** chemicals that make up the backbone of DNA.

1. _____

2. _____ [2]

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(c) A DNA molecule has four different bases.
Give the **two** base pairs in a DNA molecule.

1. _____ and _____

2. _____ and _____ [2]

(d) Name the **two** scientists who first used X-ray crystallography (diffraction) in the discovery of the structure of DNA.

_____ and _____ [2]

[Turn over

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9 **(a)** A protein, produced by genetically engineered bacteria, is used to treat diabetes.
Name this protein.

_____ [1]

(b) A different protein, called chymosin, is used to make cheese from milk.
For many years it was obtained from the stomachs of calves.
It is now produced using genetically engineered bacteria.

(i) Draw a **labelled** diagram in Box 1 to show the chymosin gene in a calf's DNA. [2]

(ii) Draw a **labelled** diagram in Box 2 to show a bacterial plasmid after the chymosin gene has been inserted into it. [2]

Box 1

Box 2

(iii) The genetically engineered bacteria are placed in a fermenter.
What do these bacteria do to produce large amounts of chymosin?

_____ [1]

(iv) Name the type of molecule used by the bacteria to build up the chymosin protein.

_____ [1]

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(v) Genetically engineered bacteria produce large amounts of chymosin. Suggest **one other** advantage of producing chymosin using genetic engineering.

_____

_____ [1]

[Turn over

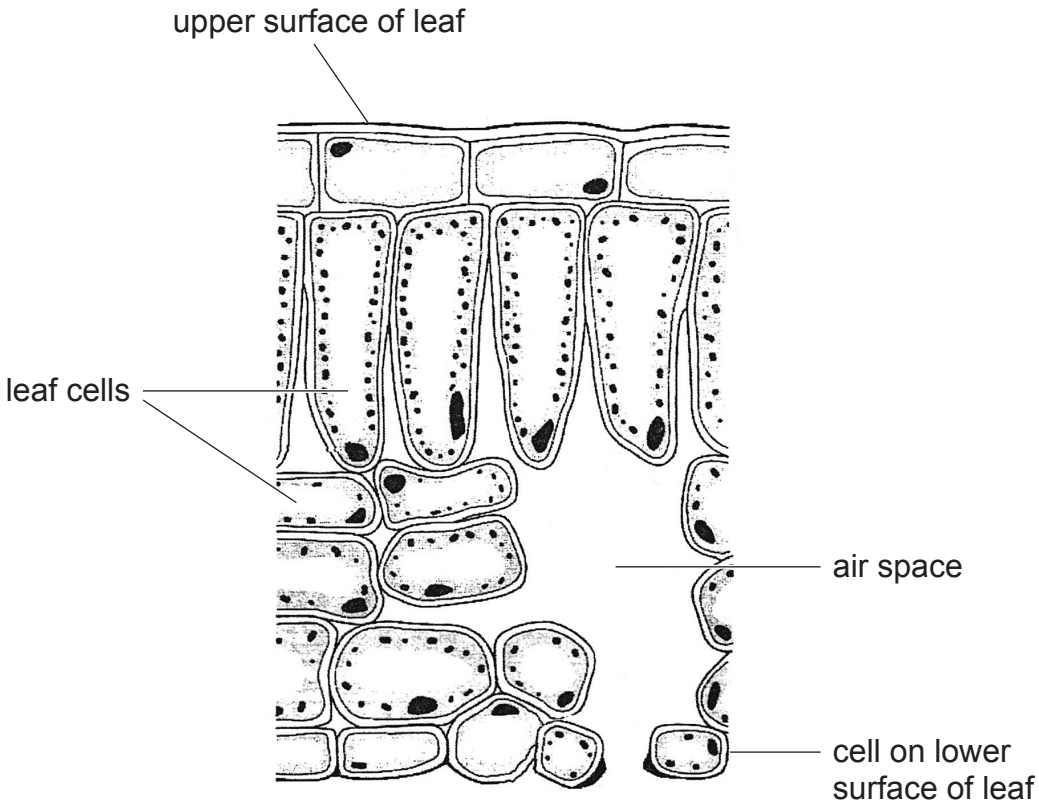
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10 (a) Plants lose water from their leaves.
The water evaporates from the leaf cells and then diffuses out through stomata.
Most plants have more stomata on the lower surface of their leaves.

(i) Name the process described above.

_____ [1]

The diagram shows a section through a leaf.



© GCSE Biology for CCEA by Rose McIlwaine and James Napier. ISBN: 9780340858257.
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(ii) Use the information above and your knowledge to draw arrows on the diagram to show the pathway of water out of the leaf. [2]

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(b) Water that is lost from leaves is usually replaced by water from the soil.
In drought conditions water may not be available in the soil to replace the water lost.

Plants in desert regions have become adapted to survive long periods of drought.
The photograph shows quiver trees from the Namib desert in Africa.



© Iaranik / iStock / Thinkstock

During long periods of drought these trees can drop all of their leaves.
Suggest how dropping all of their leaves can help quiver trees to survive long periods of drought.

_____

_____

_____

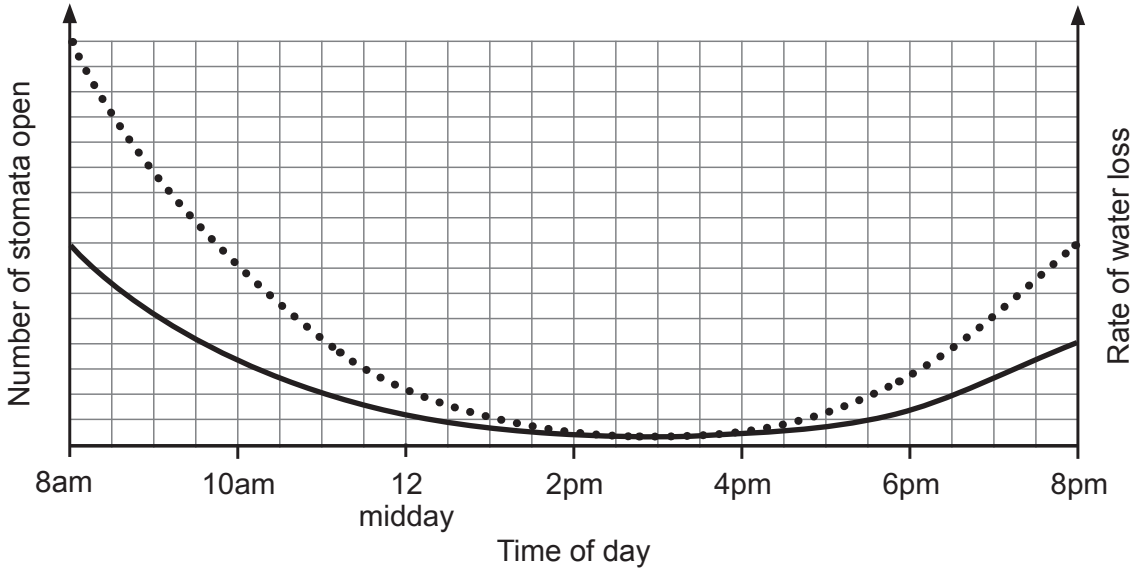
_____

_____ [2]

[Turn over

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(c) Another desert plant, called the unarmed saltwort, closes its stomata to prevent water loss.
The graph gives information about the number of stomata open and the rate of water loss in the unarmed saltwort over a 12 hour period.



Key:
•••••••••• number of stomata open ——— rate of water loss

Source: Principal Examiner

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

(i) During which **four** hour period is the least number of stomata open?

_____ to _____ [1]

(ii) Use the graph to describe the relationship between the number of stomata open and the rate of water loss in the plant.

_____

_____

_____ [1]

(iii) Draw a line on the graph to show the rate of water loss that would be expected if the stomata did **not** close over the 12 hour period. [2]

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(iv) Over a long period of time some species of desert plant became extinct as the desert became drier. The unarmed saltwort survived.

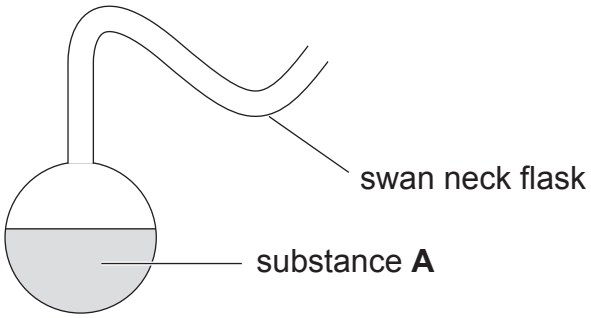
Use your knowledge of **natural selection** to explain why the unarmed saltwort survived but these other species of desert plant became extinct.

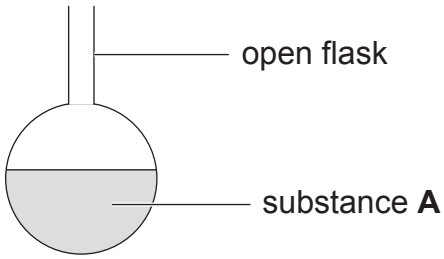
[3]

[Turn over

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11 The diagram shows the apparatus **at the start** of an investigation similar to one carried out by Louis Pasteur.





(a) (i) Name the theory Pasteur was investigating.

_____ [1]

(ii) Name substance **A** and describe how it would have been treated **before the start** of the investigation.

Name _____

Treatment _____

_____ [2]

(iii) Why was substance **A** treated in this way?

_____

_____ [1]

(iv) What results would Pasteur have observed in the two flasks if the theory he was investigating was **correct**?

_____

_____ [1]

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(b) Pasteur's results showed that the theory he was investigating was **not** correct. Describe and explain the actual results Pasteur obtained for each flask.

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	
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11	
Total Marks	

Examiner Number

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General Certificate of Secondary Education
2016

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

FRIDAY 10 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)	any antigen labelled	[1]	
		(ii)	Any three from: antigen or microbe is recognised as foreign; WBC/lymphocytes; produce antibodies/specific presence of antibodies; antibodies attached to antigen/complementary shape	[3]	
		(iii)	stops microbes spreading/stops reproducing/easier phagocytosis	[1]	
	(b)		phagocytosis; engulf; digest/accept destroy **using enzymes**	[3]	8
2	(a)	(i)	years scale on *x*-axis; points plotted correctly ([–1] for each error plotting) line/points joined with straight lines	[4]	
		(ii)	number of people living with AIDS increases with time from 2006 to 2013	[1]	
	(b)	(i)	$2.2 - 1.9 = 0.3/\frac{1.9}{2.2}/86.36$;	[2]	
		(ii)	Any **two** from four **money** spent on treatment/education/research/data, e.g. 8.8 billion more in 2013 than 2006; **people** receiving/get treatment; **fewer** new infections/fewer people newly infected with HIV; **more people** living with AIDS (not dying)	[2]	
	(c)	(i)	Jenner	[1]	
		(ii)	smallpox	[1]	11

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	AVAILABLE MARKS

3 no clear area around amoxicillin;
clear area around neomycin;
Explanation: amoxicillin didn't kill X/X is resistant to amoxicillin
Neomycin kills X/X is not resistant to neomycin [4] — 4

4 **(a)** Any **two** from:
radiotherapy or chemotherapy
fails to produce sex **hormones**/or named correct hormone/drugs
mucus hostile to sperm
STI or named; STI
blocked oviducts
radiotherapy or chemotherapy [2]

(b) **Indicative Content**
hormones given/fertility hormones given;
to increase ova production/egg production/super ovulation;
eggs collected/gathered/harvested
sperm **added** to ova/eggs
fertilisation/**nucleus** of sperm fuse with **nucleus** of ova
in Petri dish;
kept until 8 cell stage/ensure normal development
embryos inserted into the uterus
(Any **six** points) [6]

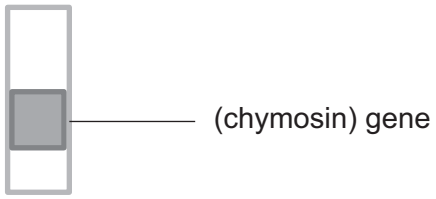
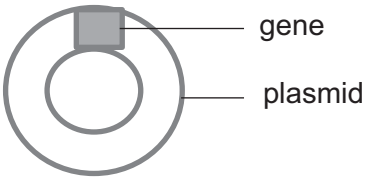
Band	Response	Mark
A	Candidates use appropriate terms throughout to give at least **five** points from the indicative content. They use good spelling, punctuation and grammar skills. Form and style are of a high standard.	[5]–[6]
B	Candidates use appropriate terms throughout to give at least **three or four** points from the indicative content. They use satisfactory spelling, punctuation and grammar. Form and style are of a satisfactory standard.	[3]–[4]
C	Candidates use appropriate terms throughout to give **one or two** points from the indicative content. They use limited spelling, punctuation and grammar and have made little use of specialist terms.	[1]–[2]
D	Response not worthy of credit.	[0]

8

			AVAILABLE MARKS
5	(a)	**Description**: level raised **Explanation** Any **two** from: water/water moves; from dilute to a more concentrated solution; through a selectively permeable membrane/semi-permeable membrane [3]	
	(b)	**vacuole** has shrunk cell membrane pulled away from the cell wall [2]	5
6	(a)	Punnett; RR for parent; Rr for parent; correct offspring [4]	
	(b)	two crosses both with rr; 1 parent RR, other parent Rr; correct crosses [4]	
	(c)	**(i)** 3:1 [1]	
		(ii) discontinuous [1]	
		(iii) blood groups/tongue rolling/(attached) ear lobes/eye colour/gender [1]	11
7	(a)	**(i)** asexual [1]	
		(ii) mitosis [1]	
	(b)	Any **two** from: large numbers; only needs 1 parent; identical/plants rare plants preserved; all year round/out of season; [2]	
	(c)	**all have** the same (genetic) disease [1]	5
8	(a)	double helix [1]	
	(b)	sugar/deoxyribose; phosphate; [2]	
	(c)	A–T/Adenine–Thymine C–G/Cytosine–Guanine [2]	
	(d)	Franklin Wilkins [2]	7

	R	R
R	RR	RR
r	Rr	Rr

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				AVAILABLE MARKS
9	**(a)**	insulin	[1]	
	(b)	**(i)**  ([1] for **drawing** of chymosin gene in a chromosome; [1] for a **correct label** – either the gene **or** chromosome)	[2]	
		(ii)  ([1] for drawing; [1] for correct label)	[2]	
		(iii) multiplication/replication/reproduction/protein synthesis	[1]	
		(iv) amino acids	[1]	
		(v) no animals used/vegetarians can eat the cheese don't have to kill animals	[1]	8
10	**(a)**	**(i)** transpiration	[1]	
		(ii) arrow from a cell to the air space (must start in a cell or edge of cell); through the **stoma** only (only with arrow going **out**);	[2]	
	(b)	less surface area/no stomata; less water loss/less evaporation	[2]	
	(c)	**(i)** 1pm–5pm/12.30–4.30/12–4	[1]	
		(ii) more stomata open, greater rate of water loss (or converse)	[1]	
		(iii) line starting at 8 squares up; increasing until midday (at least) and then starts to decrease at some stage;	[2]	
		(iv) saltwort **better adapted**/have advantageous gene saltwort plants (survive) to **reproduce** pass on **genes**/pass on allele/favourable characteristics allow **converse** answers	[3]	12

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11 (a) (i) spontaneous generation [1]

(ii) A = nutrient broth;
boiled/sterilised; [2]

(iii) to kill microbes [1]

(iv) **both** flasks cloudy [1]

(b) Indicative Content

Any five:

open flask

- open flask is **cloudy**;
- because it contains microbes;
- that have entered **from the air**;
- microbes reproduced;

swan neck flask

- swan neck flask is **clear**;
- microbes have got **trapped in the bend**;
- microbes cannot get into the flask; [6]

Band	Response	Mark
A	Candidates use appropriate terms throughout to give at least **five** points from the indicative content. They use good spelling, punctuation and grammar skills. Form and style are of a high standard.	[5]–[6]
B	Candidates use appropriate terms throughout to give at least **three or four** points from the indicative content. They use satisfactory spelling, punctuation and grammar. Form and style are of a satisfactory standard.	[3]–[4]
C	Candidates use appropriate terms throughout to give **one or two** points from the indicative content. They use limited spelling, punctuation and grammar and have made little use of specialist terms.	[1]–[2]
D	Response not worthy of credit.	[0]

Total

AVAILABLE MARKS

11

90

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Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

GSD42

FRIDAY 5 JUNE, AFTERNOON

TIME

1 hour 15 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 eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **90**.
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 **2** and **6(e)**.

9583

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1 Blood samples from three patients were analysed.
Table 1 gives the results for each patient.

Table 1

Blood samples were analysed for	Blood results for		
	Patient A	Patient B	Patient C
Blood alcohol level	high	not present	low
Level of cholesterol	high	normal	low
Carbon monoxide	normal	high	normal
Hormones:			
• Testosterone	present	absent	absent
• Oestrogen	absent	present	present
• Fertility hormones	absent	absent	present

Use the information in Table 1 and your knowledge to complete Table 2.
The first row has been completed for you.

Table 2

	Patient	Evidence
Most likely to have a heart attack	A	high cholesterol level
Is a male		
Most likely to be a smoker		
Most likely to be receiving IVF Treatment		
Most likely to be a binge drinker		

[8]

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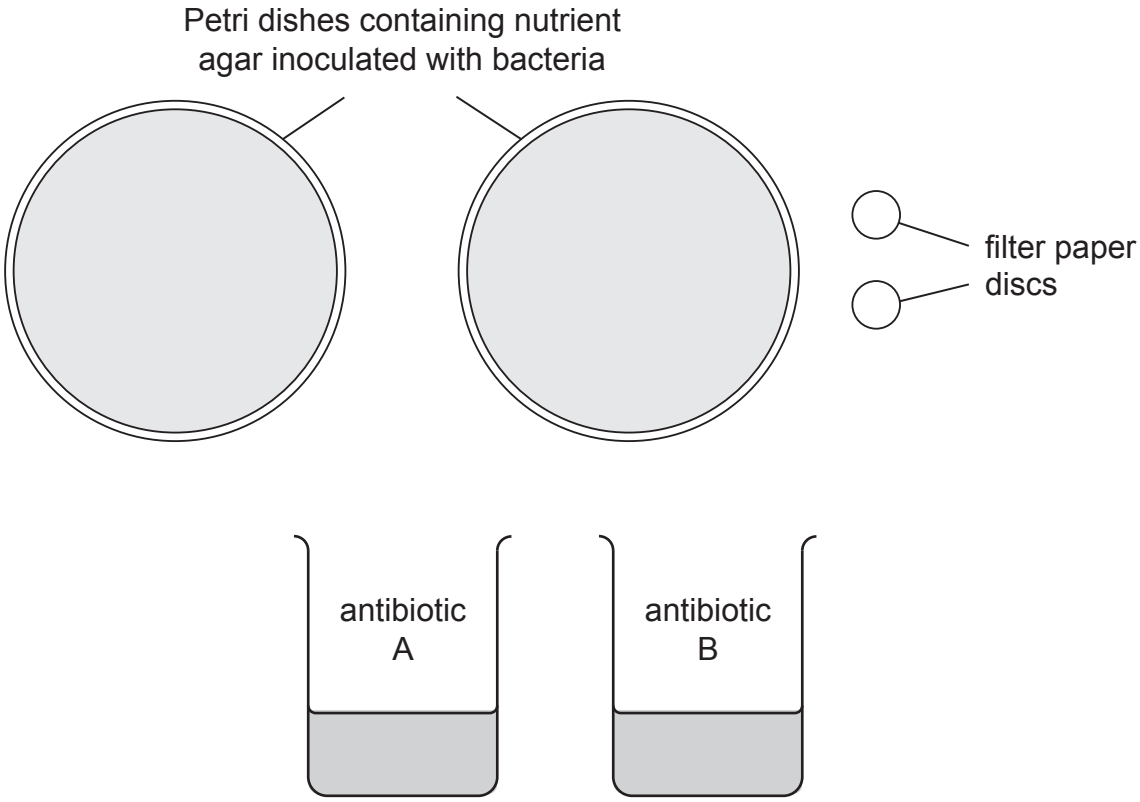
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2 A student wanted to investigate how effective two antibiotics were against a particular type of bacteria.

The student was given the following apparatus:

- two Petri dishes containing nutrient agar inoculated with the bacteria;
- two filter paper discs;
- two different antibiotic solutions.

The diagram shows the apparatus the student was given.



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Describe how the student carried out this investigation.

- Give **two** safety precautions.
- Describe and explain the results the student would obtain if antibiotic A was more effective than antibiotic B.

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

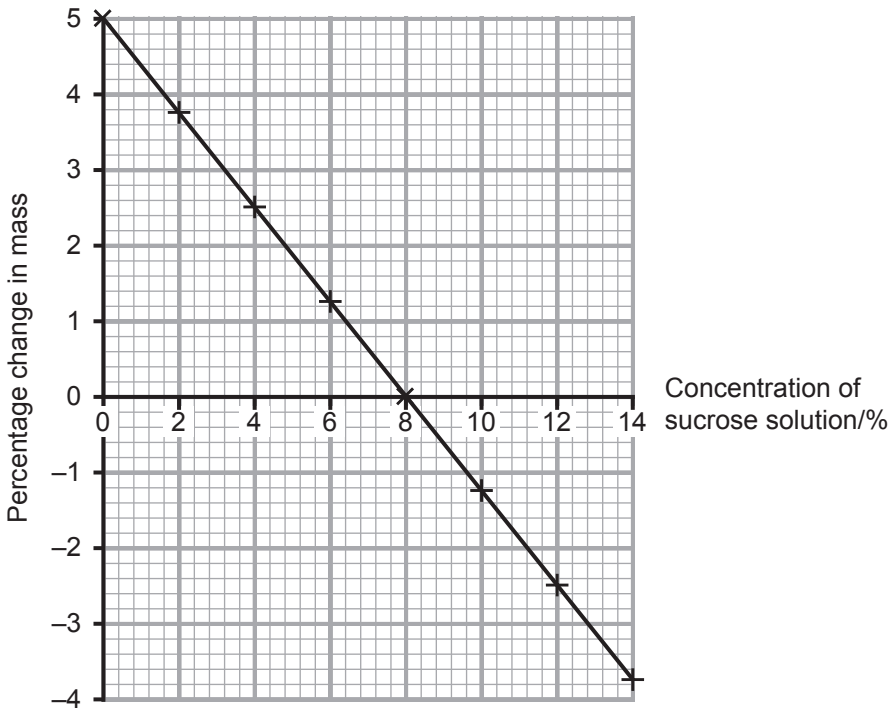
[6]

[Turn over

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3 A student recorded the mass of eight potato cylinders.
She placed one cylinder in each of eight concentrations of sucrose solution and left them for two hours.
She then reweighed the cylinders and calculated the percentage change in mass.

The graph shows her results.



(a) (i) Use the graph to find the percentage concentration of sucrose solution which gives zero percentage change in the mass of the potato cylinder.

_____ % [1]

(ii) Explain your answer.

_____

_____

_____

_____ [1]

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(b) Draw a plant cell in each box as it would appear after it had been left for 2 hours in

(i) water (0% sucrose solution).

(ii) 12% sucrose solution.
Label the cell wall and cell membrane.

(i) cell in water	**(ii)** cell in 12% sucrose solution **(Label the cell membrane and cell wall.)**

[4]

(c) What is the function of the plant cell wall in osmosis?

_____

_____

_____ [1]

[Turn over

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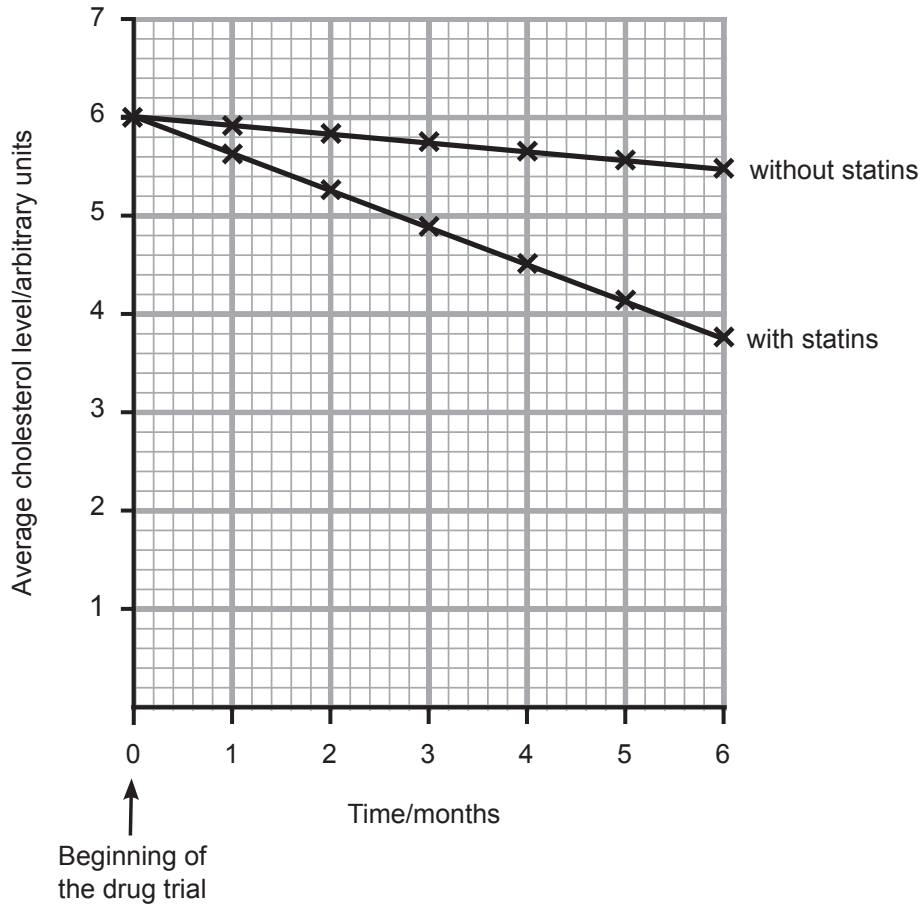
4 A high cholesterol level in the blood increases the risk of a heart attack.

(a) Explain how a high cholesterol level in the blood can lead to a heart attack.

[4]

(b) A six month drug trial involved 14 000 patients with high cholesterol levels.
It is claimed that drugs called statins reduce cholesterol levels.
Half of the patients were given statins and half were not.
All patients were told to eat a balanced diet over the period of the trial.

The graph shows the average cholesterol levels over the six months of the trial.



9583

(i) What conclusions can be drawn from this drug trial?
Use data from the graph to support your answer.

[3]

(ii) Why was the group of patients who were **not** given statins included as part of the trial?

[1]

Of the 14 000 patients who took part in the drug trial six out of seven were men.
This is because men make up a greater proportion of heart disease patients.

(iii) How many **women** took part in the drug trial?

Show your working

women [2]

[Turn over

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(iv) Some of these women found that statins did not reduce their cholesterol level. This meant that they were still at risk of having a heart attack.

Other than a balanced diet suggest **two** lifestyle changes that these women could make which would help to reduce their risk of having a heart attack.

1. _____

2. _____ [2]

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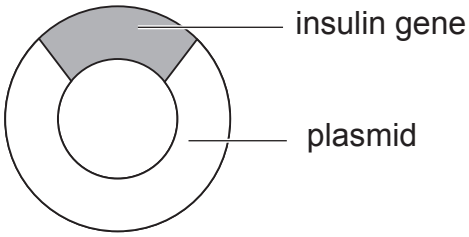
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5 Insulin is a hormone which can be made using genetic engineering.
Bacteria are used in this process.
The diagram shows a stage in the production of human insulin by genetic engineering.



(a) Describe **three** stages required to produce the plasmid shown in the diagram.

[3]

(b) The plasmid containing the insulin gene is placed back into a bacterium.
Explain how this genetically engineered bacterium can be used to produce large quantities of insulin in a short period of time.

[1]

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(c) State **two other** advantages of producing human insulin by this method.

_____

_____

_____ [2]

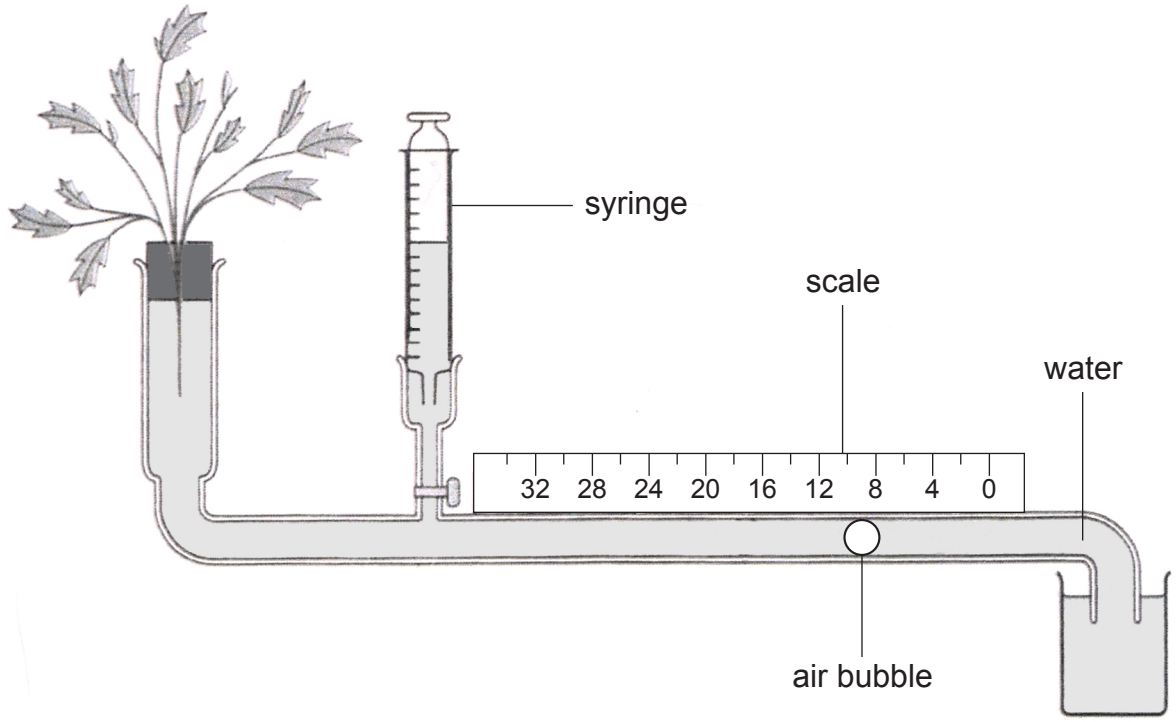
(d) Name the condition that insulin is used to treat.

_____ [1]

[Turn over

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6 **(a)** The diagram shows apparatus used to investigate the rate of transpiration in a plant shoot in different environmental conditions.



© GCSE Biology for CCEA, 2nd Edition by James Napier, Hodder Education (2011).
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(i) Name the apparatus.

_____ [1]

(ii) How is the bubble reset to zero between experiments?

_____

_____ [1]

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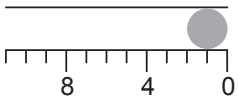
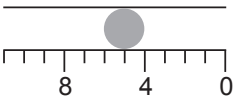
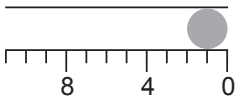
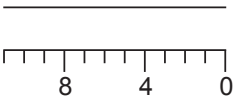
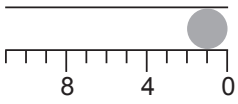
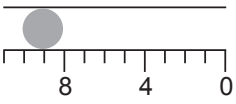
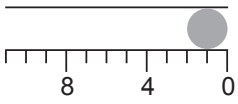
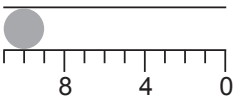
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(b) The table shows the distance moved by the air bubble under different environmental conditions over **30 minutes**.

Experiment	Environmental condition			Position of bubble at the start	Position of bubble at the end	Distance moved by bubble/mm
	Fan speed on/off	Temperature /°C	Humidity low/high			
1	off	20	low			4
2	on	20	low			6
3	off	30	low			
4	on	30	low			9

Complete the table by

(i) drawing in the position of the air bubble at the end of Experiment 2. [1]

(ii) calculating the distance moved by the air bubble in Experiment 3. [1]

(c) What is the rate of transpiration in Experiment 1 in mm **per hour?**

_____ mm per hour [1]

(d) **(i)** The distance moved by the air bubble in Experiment 1 was 4 mm.
The distance moved by the air bubble in Experiment 2 was 6 mm.

Give the environmental condition that caused this increase.

_____ [1]

(ii) Experiment 1 was repeated with high humidity. What would you expect to happen to the distance moved by the bubble?

_____ [1]

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(e) The distances moved by the air bubbles in Experiments 1 and 4 are different. Describe and explain what happened inside and around the leaf to bring about the difference in Experiment 4.

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

[6]

[Turn over

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7 MRSA is a 'superbug'. It is resistant to antibiotics and can spread quickly, particularly in hospitals.

(a) (i) What type of microorganism is MRSA?

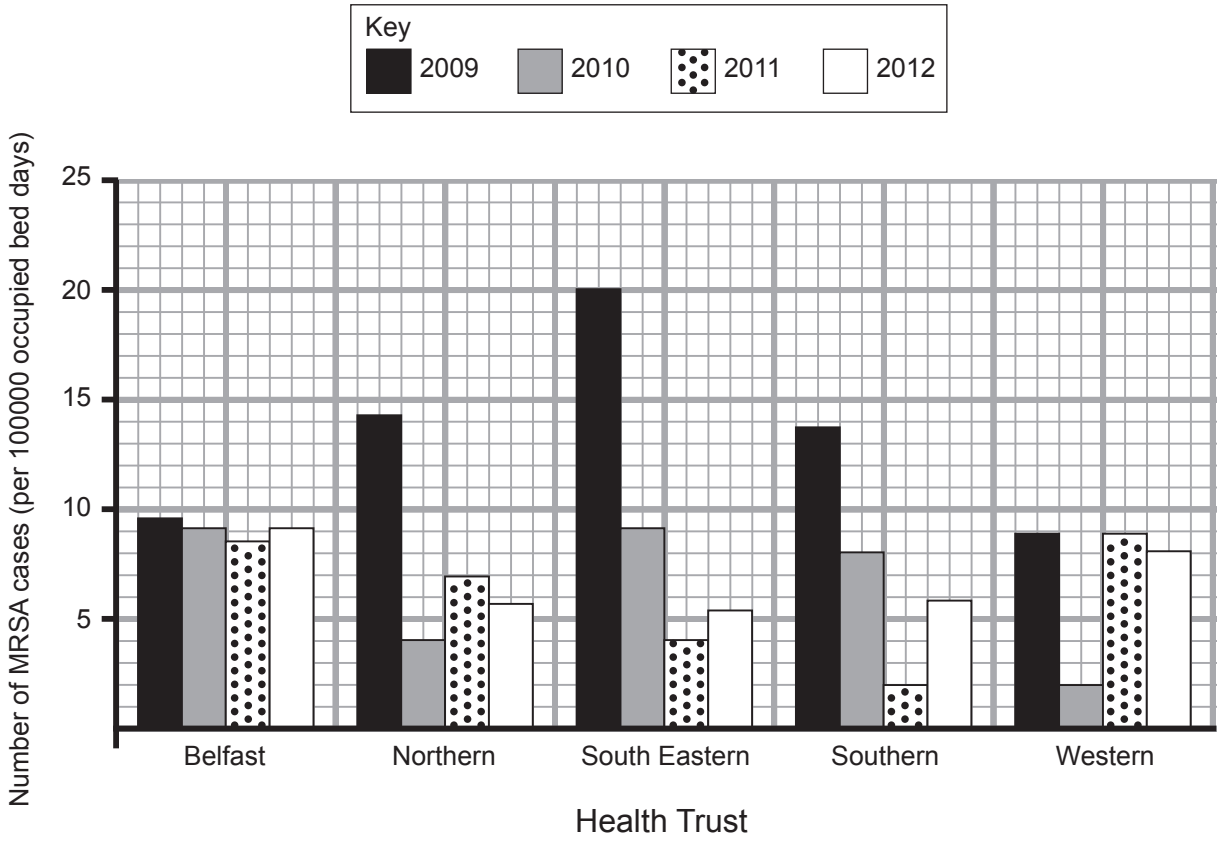
_____ [1]

(ii) Explain what is meant by the term 'resistant to antibiotics'.

_____

_____ [1]

(b) The graph below compares the number of MRSA cases in hospitals for the first three months of each year from 2009–2012 for each of the five Health Trusts in Northern Ireland.



© Adapted from HSC Public Health Agency '5 areas bacteramia surveillance quarterly report Jan-Mar 2012'.

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(i) The table compares the number of MRSA cases in the first three months of 2010 to 2012 compared to the same period the previous year for different Health Trusts.

Use the information in the graph opposite to complete the table for the Western Trust.

	Number of MRSA cases in the first three months of each year compared to the previous year		
Health Trust	**2010**	**2011**	**2012**
Belfast	decreased	decreased	increased
Northern	decreased	increased	decreased
South Eastern	decreased	decreased	increased
Southern	decreased	decreased	increased
Western			

[1]

(ii) Use the information in the table to give the Health Trust that shows the same trend as the Western Trust.

_____ [1]

(iii) Use the information in the graph opposite to calculate the percentage decrease in MRSA cases between **2009 and 2011** for the **South Eastern Trust**.

Show your working

_____ % [2]

[Turn over

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(iv) Suggest **two** ways that staff in the hospitals in this Health Trust could have brought about this decrease in MRSA cases.

1. _____

_____

2. _____

_____ [2]

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8 The photographs show strawberry plants and sunflowers.



© Simon Fraser / Science Photo Library



© Dr Neil Overy / Science Photo Library

(a) The strawberry plants reproduced asexually to give clones.

(i) What is a clone?

_____ [1]

The clones were not exactly the same height.

(ii) Suggest why the cloned strawberry plants were **not** exactly the same height.

_____

_____ [1]

(iii) What type of cell division occurs as plants grow?

_____ [1]

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(b) (i) The sunflower plants reproduced by sexual reproduction. The offspring when grown had many different heights.

Explain the reason for this variation in height.

_____

_____ [1]

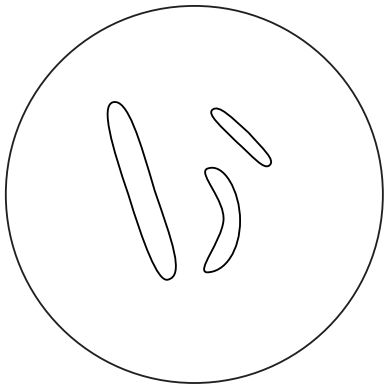
(ii) What **type** of variation is shown by the heights of the offspring sunflowers?

_____ [1]

[Turn over

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9 **(a)** The diagram shows the nucleus of a cell that has been produced by meiosis. It contains three chromosomes.



In the space draw the nucleus of this cell **before** it divided by meiosis.

[2]

(b) **(i)** Name **one** part of the human body where meiosis takes place.

_____ [1]

(ii) How many haploid cells are produced from one cell during meiosis?

_____ [1]

(iii) Human eggs and sperm each contain 23 chromosomes.
Explain the significance of this during fertilisation in terms of chromosome numbers.

_____

_____

_____ [1]

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(c) Scientists often collaborate or use data from each other in order to develop theories and make discoveries.

In the 1950s, the structure of DNA was discovered as a result of research carried out by different scientists; Rosalind Franklin and Maurice Wilkins, Edwin Chargaff, James Watson and Francis Crick.

Outline the contribution made by each in the understanding of the structure of DNA as a double helix.

Franklin and Wilkins

Chargaff

Watson and Crick

[3]

[Turn over

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10 The human body has a number of mechanisms to deal with disease-causing microorganisms.
The first line of defence is to prevent the microorganisms from entering the body.

(a) Describe **two** ways microorganisms are prevented from entering the body.

1. _____

_____

2. _____

_____ [2]

(b) If microorganisms such as bacteria do get into the body, the body responds by producing antibodies.

Describe how the presence of a specific microorganism results in the production of antibodies.

_____

_____

_____

_____

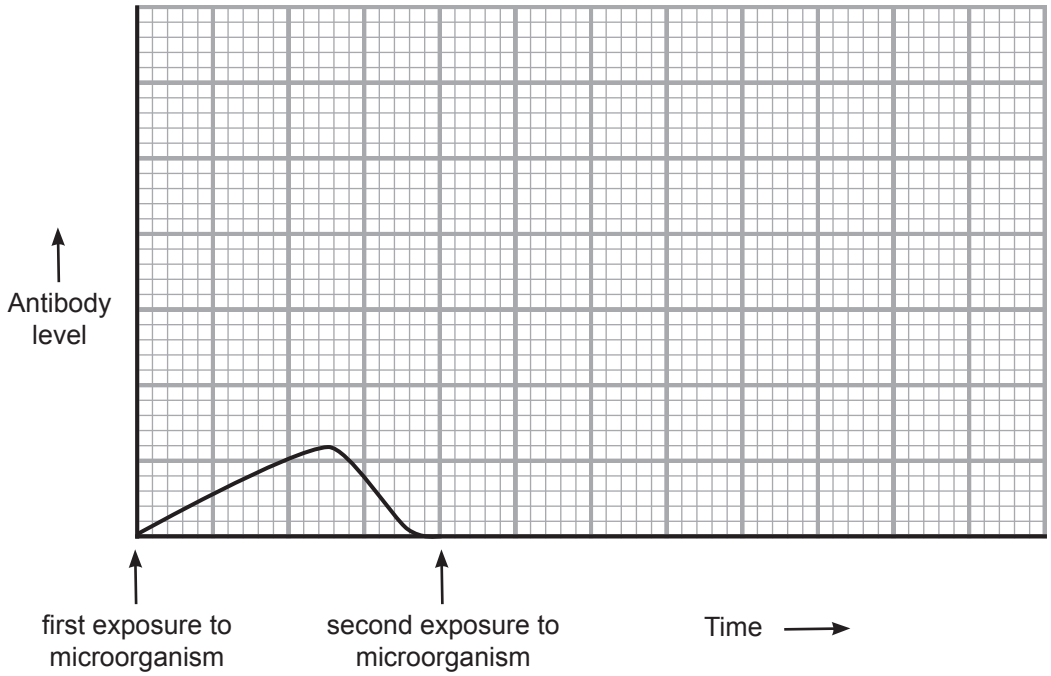
_____

_____ [2]

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(c) A person was exposed to the same type of microorganism on a second occasion.

On the graph, draw a line for the time period given to show the antibody level that you would expect.

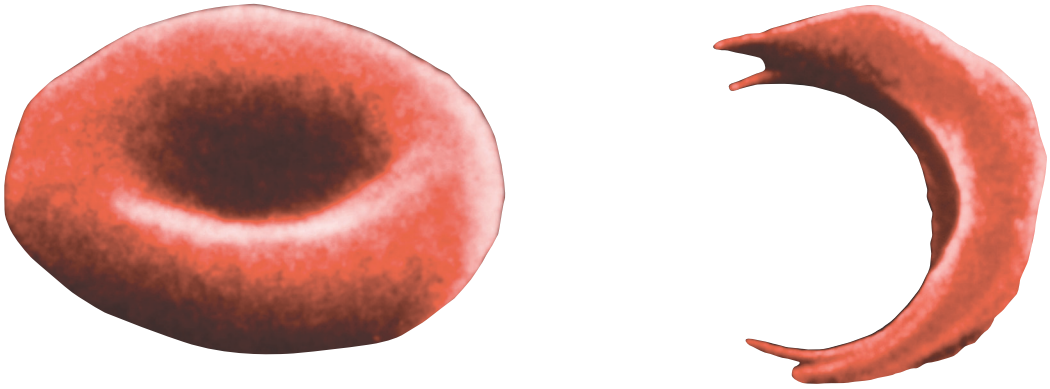


[3]

[Turn over

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11 Sickle cell anaemia is a recessive inherited condition which affects red blood cells. The photograph shows a normal red blood cell and a sickle-shaped red blood cell.



© Mary Martin / Science Photo Library

People who are homozygous recessive for the condition suffer from sickle cell anaemia.
People who are heterozygous for the condition are carriers for sickle cell anaemia.

Let b represent the allele for sickle cell anaemia.

(a) Draw a Punnett square to show how two parents who do **not** suffer from sickle cell anaemia could have a child who does suffer from sickle cell anaemia.

[4]

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(b) The National Health Service (NHS) offers screening to some parents during pregnancy so they can find out if they are carriers for sickle cell anaemia. This will inform them if they are at risk of having a baby with sickle cell anaemia.

The mother is screened first. The father is only screened if the mother is a carrier.

(i) Explain why it is **only necessary** to screen the father if the mother is a carrier for sickle cell anaemia.

_____

_____ [1]

(ii) Suggest the benefit **to the NHS** of only screening the father if the mother is a carrier for sickle cell anaemia.

_____ [1]

(c) Individuals who are carriers for sickle cell anaemia have a natural protection against malaria.

Malaria is carried by mosquitoes. It causes more than one million deaths per year.

Use the **theory of natural selection** and the information above to explain why there is a higher percentage of the population who are carriers for sickle cell anaemia in areas where malaria is common.

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over

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[3]

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

Examiner Number

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Rewarding Learning

General Certificate of Secondary Education
2015

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

FRIDAY 5 JUNE, AFTERNOON

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.

1

	Patient/s who is/are	Evidence	
Male	A;	Testosterone	;
Most likely to be a smoker	B;	CO/carbon monoxide	;
Most likely to be receiving IVF treatment	C;	Fertility hormones	;
Most likely to be a binge drinker	A;	**High** blood alcohol levels	;

[8]

AVAILABLE MARKS: 8

2 Indicative content

Any **six** from:

- dip/soak **a** disc in an antibiotic or both discs
- set discs on agar
- incubate/more than 1 day/leave for 24 hrs or more
- at 25°C/less than 25°C/about 25°C
- seal/use sellotape/do not reopen
- autoclave/sterilise after/safe disposal/wipe benches with alcohol/disinfectant (before or after)
- **A** has a bigger clear area
- **A** kills **more** bacteria/prevents **more** growth/**more** bacteria destroyed

Response	Mark
Candidates give 5 or 6 points from the indicative content to describe how to set up the Petri dishes and interpret the results and give safety precautions for the investigation. They use good spelling, punctuation and grammar and form and style are of a high standard.	[5]–[6]
Candidates give 3 or 4 points from the indicative content to describe how to set up the agar plates or interpret results or give safety precautions for this investigation.	[3]–[4]
Candidates give 1 or 2 points from the indicative content to describe how to set up the agar plates or interpret results or give safety precautions for this investigation.	[1]–[2]
Response not worthy of credit.	[0]

[6]

AVAILABLE MARKS: 6

					AVAILABLE MARKS
3	**(a)**	**(i)**	8%;	[1]	
		(ii)	No net movement of water/water is neither moving into or out of potato; Concentrations inside and outside are equal/isotonic;	[1]	
	(b)	**(i)**	Turgid cell drawn; looks more turgid than in **(ii)**;	[1]	
		(ii)	Correct label for cell wall **must** be a double line	[1]	
			Correct label for cell membrane;	[1]	
			Plasmolysed cell drawn/cell membrane pulled away from wall at all or some parts;	[1]	
	(c)		Cell wall = limits the entry of water/stops cell from bursting/stops lysis	[1]	7
4	**(a)**		Any **four** from five points: • fat/fatty deposits/cholesterol in the blood vessel/coronary arteries • blockage/clot/reduces or stops the blood flow (to heart muscle) • less oxygen/glucose (reaches the heart muscle) • no or less respiration • Muscle cells die/cells die/heart stops **beating**/heart stops **contracting**	[4]	
	(b)	**(i)**	Any **three** from four: **Reduction statement** – cholesterol reduced with statins **or** reduced without statins/with diet; • statins reduce the cholesterol level from 6 to 3.8 units/by 2.2 units • without statins/cholesterol levels are reduced to 5.5/0.5 **Comparison mark** • statins reduce cholesterol levels **more** than without statins • statins reduce it **faster**/or difference from 5.5 to 3.8 or difference of 1.7 Maximum [2] for data (after 6 months)	[3]	
		(ii)	To **compare** this group with those that took statins/as a **control**/to see if diet alone can bring down cholesterol/to see if the statins make the level drop **faster**;	[1]	
		(iii)	**12000** men; = 2000 women; Correct answer [2]	[2]	
		(iv)	Any **two** from: • Reduce salt intake/less salt • Exercise/more sport (described) • Reduce stress • Don’t smoke/give up smoking • Don’t binge drink/don't drink/drink less/no alcohol	[2]	12

			AVAILABLE MARKS
5	**(a)**	Any **three** from: • Remove the **gene for insulin** • Remove the plasmid (from the bacterium) • Cut the plasmid open/split the plasmid open • Insert insulin gene (into plasmid/bacterial DNA) [3]	
	(b)	The bacteria reproduce/clone themselves/bacteria put into a fermenter/ bioreactor; [1]	
	(c)	Any **two** from: • human insulin has no side effects/no allergic reactions/no rejection • don't have to kill/harm any animals/no ethical issues; [2]	
	(d)	Diabetes; [1]	7

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AVAILABLE MARKS

6 **(a)** **(i)** Potometer [1]

(ii) Use the syringe; [1]

(b) **(i)** Air bubble drawn in correctly/right hand side of the bubble must start at 6; [1]

(ii) 8 mm [1]

(c) 8; [1]

(d) **(i)** Fan **or** wind; [1]

(ii) Bubble move less/decreases/bubble doesn't move at all; [1]

(e) **Indicative content**

Any **five** from:

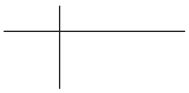
- warmer/temperature higher in 4;
- windier/the fan is on in 4;
- **more** evaporation (inside the air spaces or cells in leaf);
- **more** diffusion (inside the air spaces or cells in leaf);
- **higher** rate of transpiration/more transpiration
- through the stomata
- maintain diffusion gradient

Response	Mark
Candidates must use appropriate specialist terms throughout to describe and compare the results for experiments 1 and 4 and what happens in the leaf to bring about these results (using **five or more** of the above points). They use good spelling, punctuation and grammar and form and style are of a high standard).	[5]–[6]
Candidates use some appropriate specialist terms to describe and compare the results for experiments 1 and 4 and what happens in the leaf to bring about these results (using **three or four** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give one or two points and partially describe the results in experiments 1 and 5. They use limited spelling, punctuation or grammar skills).	[1]–[2]
Response not worthy of credit.	[0]

[6]

13

					AVAILABLE MARKS
7	(a)	(i)	Bacteria;	[1]	
		(ii)	Bacteria are not killed by antibiotics;	[1]	
	(b)	(i)	Health Trust 2010 2011 2012 Western decreased increased decreased	[1]	
		(ii)	Northern;	[1]	
		(iii)	20 – 4 **or** 20 (cases) to 4 (cases)/**or** reduction of 16 = [1] = 80% Correct answer [2]	[2]	
		(iv)	Any **two** from: • pretest patients • isolation of patients (with MRSA) • protective clothing when dealing with patients with MRSA/wear gloves/goggles etc • washing hands between dealing with patients/washing hands **more frequently** • deep clean wards/sterilising surfaces or equipment/cleaning toilets/floors/hospital/wards more frequently/mop up spills • use hand sanitiser;	[2]	8
8	(a)	(i)	**Genetically** identical;	[1]	
		(ii)	They may have been grown in different (environmental) factors/ described	[1]	
		(iii)	Mitosis;	[1]	
	(b)	(i)	**Genetic** variation/different genes or alleles or mixture of genotypes;	[1]	
		(ii)	Continuous;	[1]	5
9	(a)		6 chromosomes; 3 pairs (but don't have to be lined up in pairs);	[2]	
	(b)	(i)	Ovaries/testes;	[1]	
		(ii)	4;	[1]	
		(iii)	(Need to restore) **46**/**diploid** (number);	[1]	
	(c)		Franklin and Wilkins – X-ray/diffraction/crystallography; Chargaff – base pairs/relative amounts of **each** base pair/A = T/C = G; Watson and Crick – 3D model;	[3]	8

			AVAILABLE MARKS
10	**(a)**	Any **two** from: • vaginal secretions • stomach acid • ear wax • blood clots (at wound to prevent entry) • mucous membranes • tears/lysozymes • **nasal** hairs • skin (is physical barrier to entry); [2]	
	(b)	Any **two** from three: • **antigens** on microorganism; • trigger **WBC/lymphocyte**; • antibodies are complementary in shape to the antigens [2]	
	(c)	**Steeper** gradient; **higher** antibody level (higher than the peak already drawn); stays high – for longer than original; [3]	7
11	**(a)**	Punnett square  ; gametes correct; × 2; correct cross; [4]	

	B	b
B	BB	Bb
b	Bb	bb

	(b)	**(i)** Baby won't have sickle cell anaemia unless **both** parents are carriers/ unless it has two b/two recessive alleles, i.e. one allele from each parent/ If mother doesn't have the gene/allele there is **no chance** of the baby having it [1]	
		(ii) more cost-effective/save time; [1]	
	(c)	Any **three** from: • have advantageous characteristic/allele/beneficial to be a carrier/or described people who are carriers/don't get malaria if bitten; (**NOT** natural protection as advantageous mark – already in question) • more sickle cell carriers survive • to reproduce/reproductive age; • pass on allele/gene/carrier gene/characteristic/trait [3]	9
		Total	**90**

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2014

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

GSD42

FRIDAY 6 JUNE 2014, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **90**.
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 5(b) and 7(b)**.

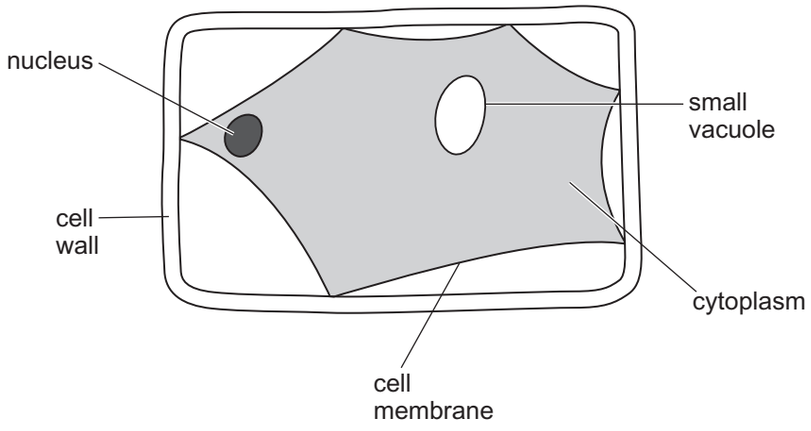
For Examiner's use only	
Question Number	**Marks**
1	
2	
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10	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram below shows a plant cell as seen under a microscope. The cell had been left in strong sugar solution for 30 minutes.



© CCEA

(a) What term describes the cell as it appears in the diagram?

_____ [1]

(b) Redraw the cell, **to the same scale**, as it would appear after being left in water for 30 minutes.
Label the **cell wall**, **cell membrane** and **vacuole** on your drawing.

[4]

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Examiner Only	
Marks	Remark

2 **(a)** The photograph below shows the type of mosquito which can carry the virus that causes the disease yellow fever. When a person is bitten by this type of mosquito, the virus can be passed to that person. Approximately 7% of people who catch yellow fever die from it within three weeks.



© Sinclair Stammars/ Science Photo Library

Paul is planning to visit Africa and has been advised to be vaccinated against yellow fever before he travels.

Suggest two reasons why Paul should be vaccinated before he travels.

1. _____

2. _____ [2]

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(b) The MMR vaccine gives immunity against measles, mumps and rubella.

The table below shows the percentage of the population who received the MMR vaccine in 2011, in the different regions of the United Kingdom.

Region of United Kingdom	Percentage of the population who received the MMR vaccine
England	89.1
Wales	91.5
Scotland	93.2
Northern Ireland	92.9

(i) Calculate the difference in the percentage of the population who received the MMR vaccine in Northern Ireland compared to England.

_____ % [1]

In 2011, there were fewer cases of measles in Northern Ireland than in England.

(ii) Suggest **one** reason why there were fewer cases of measles in Northern Ireland than in England, in 2011.

_____

_____ [1]

(iii) Name the scientist who developed the first vaccine.

_____ [1]

Examiner Only

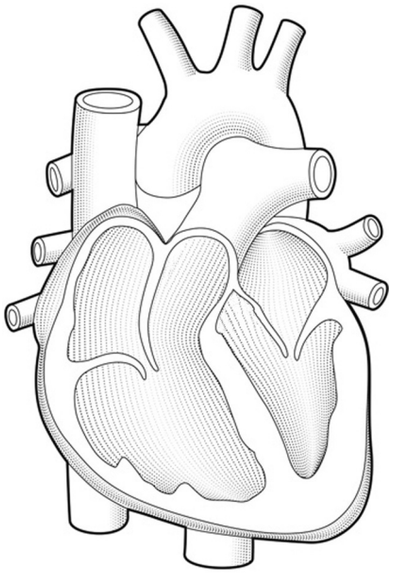
Marks	Remark

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Examiner Only	
Marks	Remark

3 The heart pumps blood around the body.

(a) The diagram below shows a section through the heart.



© Paul Wootton/ Science Photo Library

On the diagram, label the left ventricle and the pulmonary artery.

[2]

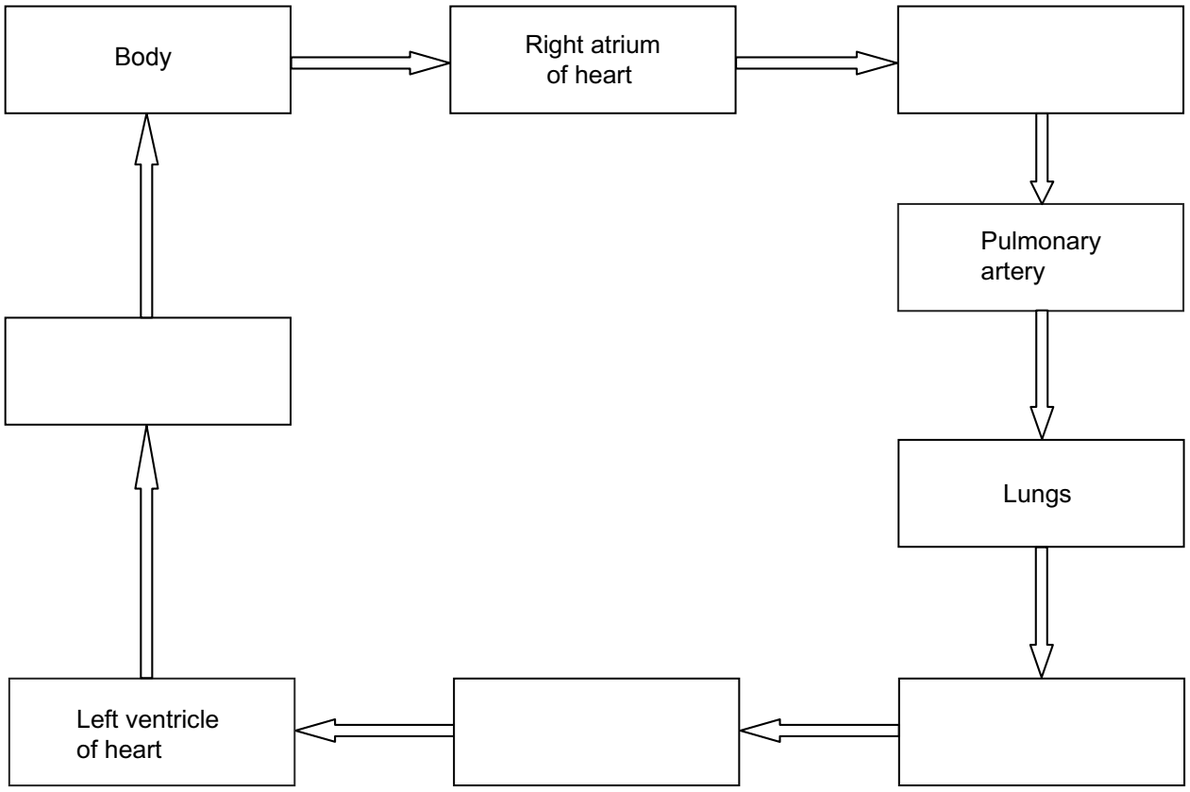
Blood passes through the heart twice during one complete circuit of the body.

(b) What term is used to describe the passage of blood twice through the heart during one complete circuit of the body?

_____ [1]

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(c) In the diagram below, fill in the empty boxes to show the passage of blood through the heart and around the body.
The empty boxes represent heart chambers or blood vessels.



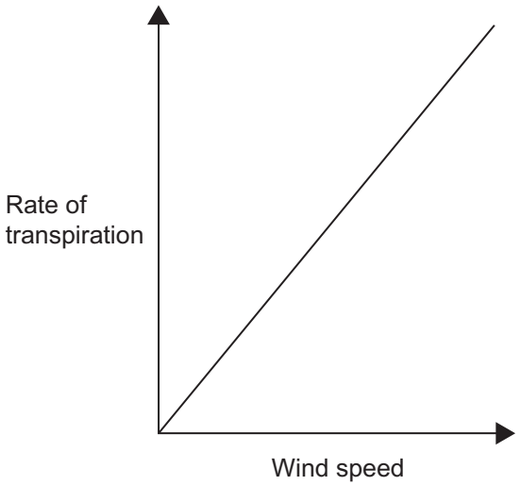
[4]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** The graph below shows the effect of increasing wind speed on the rate of transpiration in plants.



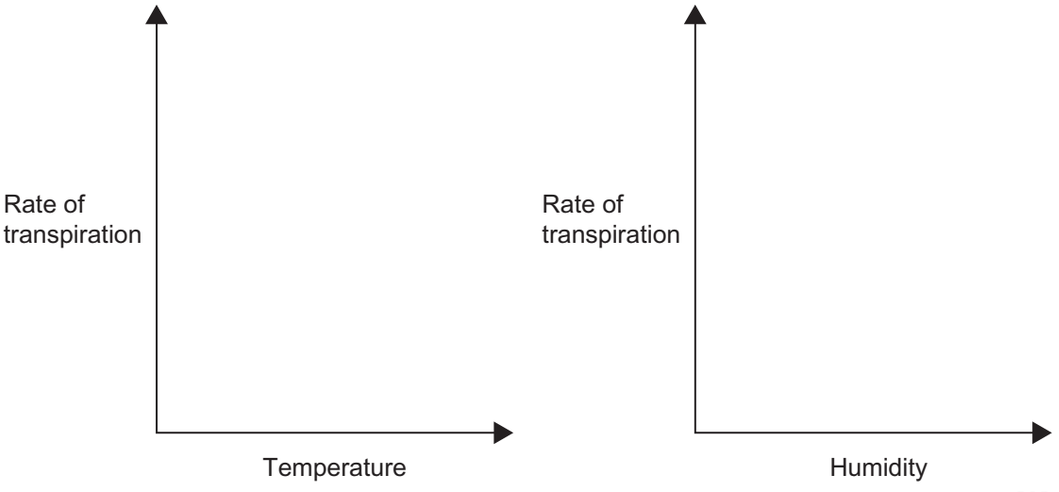
(i) Using the graph, describe the trend shown.

_____

_____ [1]

Temperature and humidity are two other factors that have an effect on the rate of transpiration in plants.

(ii) On the axes below, draw a line to show the effect of increasing temperature and a line to show the effect of increasing humidity on the rate of transpiration.

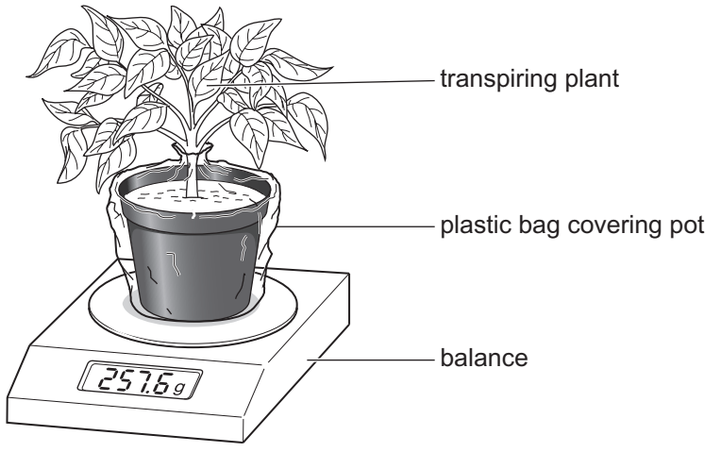


[2]

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Examiner Only	
Marks	Remark

(b) The diagram below shows apparatus used to investigate the effect of surface area of leaves on the rate of transpiration in a plant.



© CCEA

(i) Suggest why the pot was covered with a plastic bag.

_____ [1]

The plant was weighed, left for **24 hours** and then reweighed.

The **rate** of transpiration was calculated as 3.8 g per hour.

Some leaves were removed from the plant and the experiment was repeated.

The table below shows the result for the second experiment.

Mass of plant at start /g	Mass of plant after 24 hours /g
257.6	185.6

(ii) Using the data in the table above, calculate the rate of transpiration (in g per hour) in the second experiment.

Show your working.

_____ g per hour [2]

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(iii) Explain why the rate of transpiration is lower when some leaves were removed.

_____

_____ [2]

(iv) Plants use water in transpiration.

Give two **other** uses of water by a plant.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

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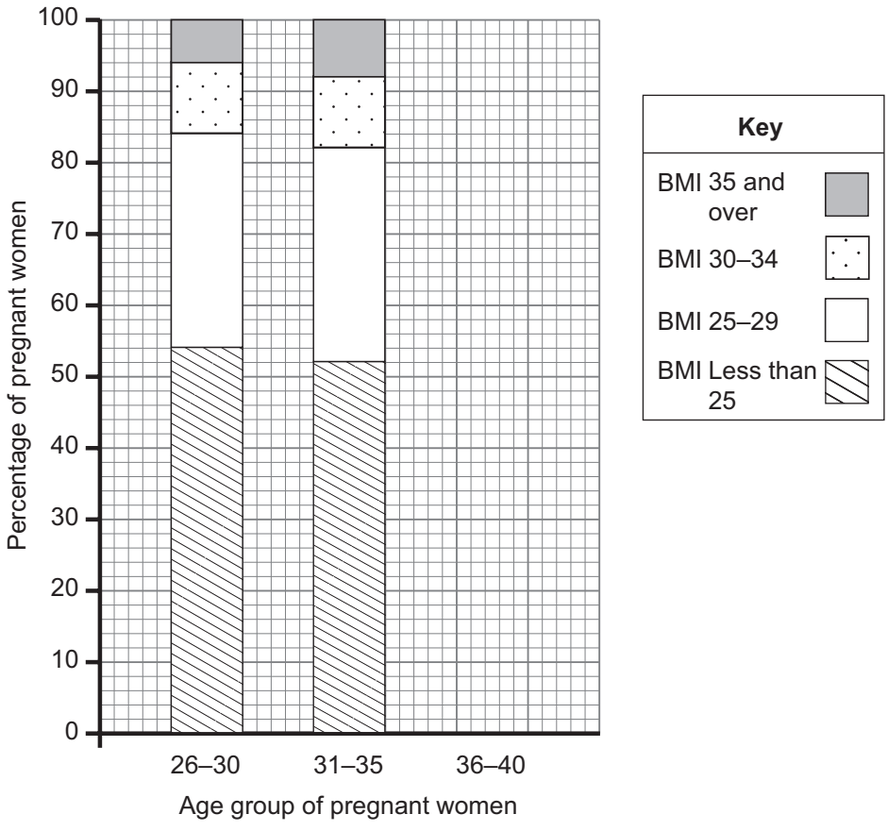
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Examiner Only	
Marks	Remark

5 **(a)** Obesity in pregnant women can increase the risk of health problems in the developing baby.

The graph below shows the BMI (body mass index) of pregnant women, in different age groups, in Northern Ireland in 2010–2011.



Women are defined as being obese if they have a BMI of 30 and over.

(i) What percentage of pregnant women aged 31–35 were classed as being obese?

Show your working.

_____ % [2]

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The table below shows the BMI of pregnant women aged 36–40.

BMI	Key	Percentage of pregnant women aged 36–40
35 and over		10
30–34		10
25–29		38
Less than 25		42

[3]

(ii) **Complete the graph opposite** by using this data to draw the bar for pregnant women aged 36–40.

(iii) Using the completed graph, give the age group of pregnant women that is **least** likely to have a developing baby with health problems.

_____ [1]

(b) As well as causing problems in pregnancy, obesity can result in high cholesterol levels.

Describe and explain how a diet which is high in cholesterol could lead to a heart attack.

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

_____

_____

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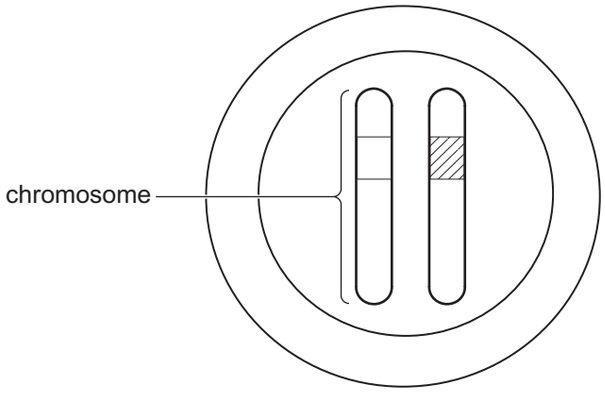
_____ [6]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

6 **(a)** The diagram below shows a cell containing a nucleus with two chromosomes.



© CCEA

(i) Name the molecule that makes up chromosomes.

_____ [1]

(ii) In the space below, draw the cells and chromosomes that would be produced when this cell divides by **mitosis**.

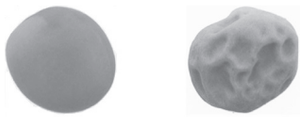
[3]

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(b) Genes control characteristics in organisms.

Peas can be smooth or wrinkled.

This characteristic is shown in the photograph below.



smooth wrinkled

© Walter Eberhart, Visuals Unlimited/ Science Photo Library

Let H represent the allele for smooth peas.

Let h represent the allele for wrinkled peas.

(i) Using a Punnett square, show the possible offspring produced when a heterozygous, smooth pea plant is crossed with a wrinkled pea plant.

[4]

(ii) Using your Punnett square, give the ratio of smooth pea plants to wrinkled pea plants.

_____ [1]

Examiner Only	
Marks	Remark

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(c) Explain how a test (back) cross could be used to determine the possible genotypes of a smooth pea plant.

Examiner Only	
Marks	Remark

[3]

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(Questions continue overleaf)

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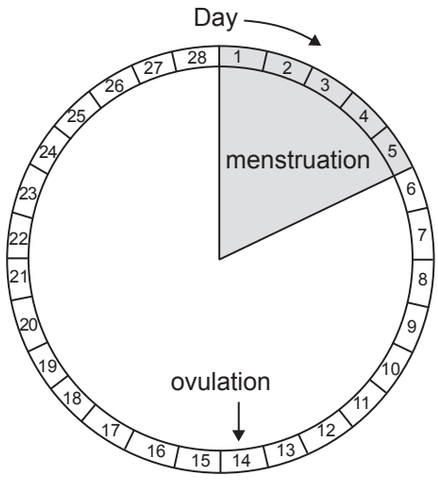
Examiner Only	
Marks	Remark

7 Sex hormones are involved in the menstrual cycle.

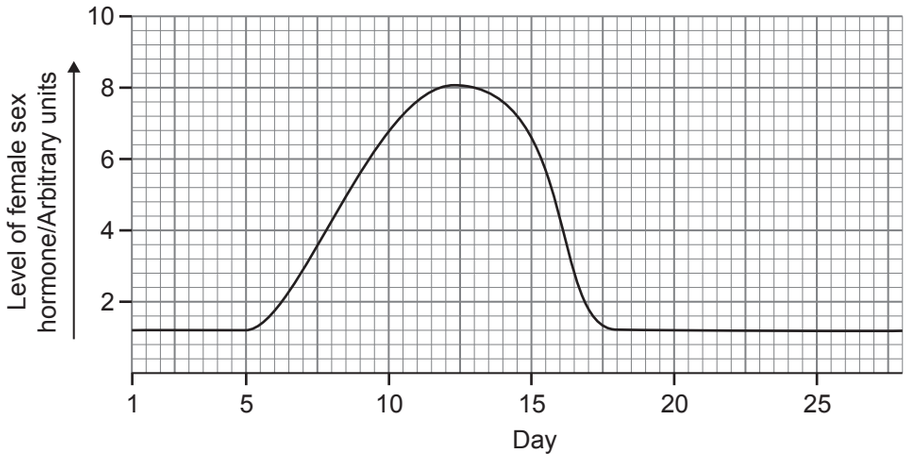
(a) How are hormones transported around the body?

_____ [1]

(b) The diagram below shows a 28 day menstrual cycle.



The graph below shows how levels of a female sex hormone change during the menstrual cycle.



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Using the diagram, the graph and your knowledge, describe the changes during the menstrual cycle from Day 1 to Day 16.

Suggest how the events of the menstrual cycle are linked to the hormone levels shown in the graph.

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

[6]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

(c) In vitro fertilisation (IVF) may be used to treat childless couples who have fertility problems.

(i) How are zygotes produced in the laboratory during IVF?

_____

_____ [2]

(ii) Suggest **one** reason why zygotes produced during IVF are left to grow to the eight cell stage (embryo) before being transferred into the uterus.

_____

_____ [1]

(iii) Suggest two ethical issues associated with IVF.

1. _____

2. _____ [2]

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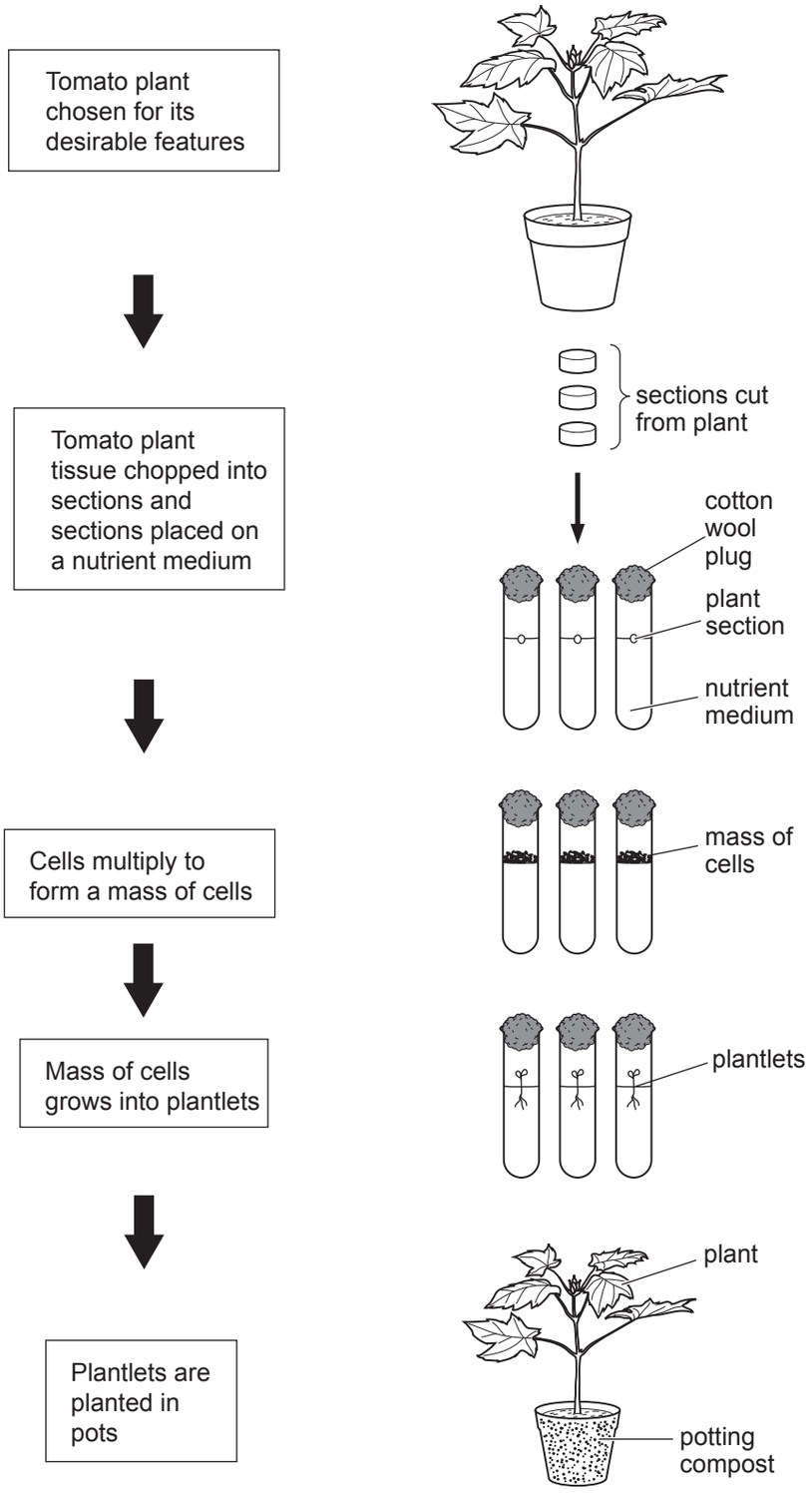
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Examiner Only	
Marks	Remark

8 **(a)** Explain why cloning in plants can be described as asexual reproduction.

_____ [1]

(b) The diagram shows one method of asexual reproduction by which plants can be cloned.



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(i) What is the name given to this method of asexual reproduction (cloning) in plants?

_____ [1]

(ii) It is important for a grower to select a suitable plant for this method. Suggest two desirable features that a suitable plant would have.

1. _____

2. _____ [2]

(iii) Suggest **one** disadvantage of cloning.

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

9 In a grassland there were equal numbers of brown and white rabbits. A farmer changed the use of this land from grassland to woodland.

Several years after the change in land use he surveyed the rabbit population. The results showed that there was the same number of rabbits but the number of brown rabbits had increased while the number of white rabbits had decreased.

Foxes hunt and eat rabbits. The population of foxes in the area did not change.

(a) Describe how natural selection can account for the **increase** in the number of brown rabbits in the rabbit population as a result of the change in land use.

_____

_____

_____

_____

_____

_____ [4]

(b) Suggest two changes that could cause the number of **white** rabbits in the population to increase in the future.

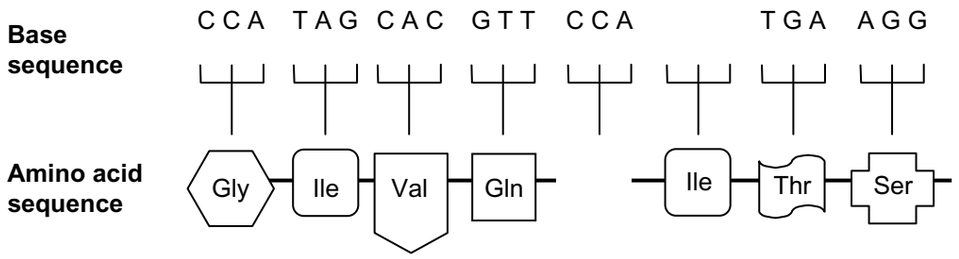
1. _____

2. _____ [2]

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Examiner Only	
Marks	Remark

10 (a) The diagram below shows part of the base sequence of DNA which is used to code for specific amino acids. The amino acids join to make a protein molecule such as insulin.



(i) Complete the diagram by:

- adding the missing three bases in the base sequence.
- drawing the missing amino acid in the amino acid sequence.

[2]

(ii) Insulin is a protein made up of 51 amino acids.

How many bases are needed to code for this protein?

_____ [1]

(iii) Explain what would happen if the first base (C) in the base sequence above was removed.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

(b) Bacteria can be genetically engineered to make human insulin to treat people with diabetes.

(i) Draw a genetically engineered bacterium which contains a gene for human insulin.

Label the human insulin gene and the plasmid.

[3]

(ii) The genetically engineered bacterium is placed in a fermenter with optimum conditions.

What happens next so that large quantities of human insulin can be produced?

_____ [1]

(iii) Until scientists developed the process of producing insulin by genetic engineering, it was obtained from cows and pigs.

State **two** advantages of producing human insulin by genetic engineering.

_____

_____

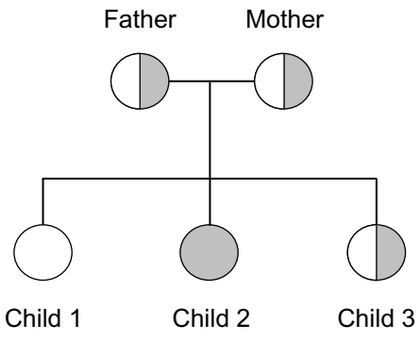
_____ [2]

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Examiner Only	
Marks	Remark

(c) Cystic fibrosis is an inherited condition. The diagram below shows how two parents who are carriers can have a child with cystic fibrosis.

A carrier is a person who has an allele for a condition but does not have the condition.



Key	
○	does not have cystic fibrosis and is not a carrier
◑	does not have cystic fibrosis but is a carrier
●	has cystic fibrosis

(i) Using the diagram and your knowledge, explain how two parents who are carriers can have a child with cystic fibrosis.

_____

_____

_____

_____ [2]

(ii) Anne and Niall have a child with cystic fibrosis.

Anne is pregnant with a second baby and has asked her doctor for information on genetic screening.

Suggest two ethical issues associated with genetic screening during pregnancy.

1. _____

2. _____ [2]

(iii) Cystic fibrosis is caused by a change in the genes.

Name one genetic condition that is caused by a change in the **number of chromosomes**.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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178399

Rewarding Learning

General Certificate of Secondary Education
2014

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

FRIDAY 6 JUNE 2014, AFTERNOON

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)**	Plasmolysed;	[1]	
	(b)	Same size; Membrane against cell wall <u>and labelled</u>; Cell wall <u>correctly labelled</u> Vacuole drawn <u>larger</u>;	[4]	5
2	**(a)**	Any **two** from: • Antibiotics won't be effective/treatment of viral diseases difficult • Might not be able to get good medical care • Hard to avoid being bitten • To provide him with immunity/to get high levels of antibodies	[2]	
	(b) **(i)**	3.8;	[1]	
	(ii)	Higher percentage of the population in NI were vaccinated. Bigger population in England/converse;	[1]	
	(iii)	Jenner;	[1]	5
3	**(a)**	Correctly labelled	[2]	
	(b)	<u>Double circulation</u>;	[1]	
	(c)	Clockwise order Right ventricle; Pulmonary vein; Left atrium; Aorta;	[4]	7
4	**(a)** **(i)**	As wind increases, the rate of transpiration increases;	[1]	
	(ii)	As the temperature increases, the rate of transpiration increases; As the humidity increases, the rate of transpiration decreases;	[2]	
	(b) **(i)**	To prevent evaporation <u>from the soil/pot</u>;	[1]	
	(ii)	(257.6 – 185.6);/ or ÷ 24 [1] **or** 3 g per hour	[2]	
	(iii)	Any **two** from: • Less surface area/less stomata • Less evaporation/diffusion of water	[2]	
	(iv)	Any **two** from: • Photosynthesis • Support • Transport	[2]	10

AVAILABLE MARKS

5 **(a)** **(i)** Read graph at 82%; 100 – 82 =18 [2]

(ii) Up to 42;
Line at 80;
Line at 90; [3]
(maximum [2] if no shading)

(iii) age 26–30; [1]

(b) **Indicative content**

- Cholesterol laid down in walls
- Of **coronary** arteries
- Reducing blood flow
- Less glucose/oxygen available
- For respiration
- Heart muscle cells die
- So heart can't contract [6]

Response	Mark
Candidates must use appropriate specialist terms throughout to describe how a heart attack occurs (using at least five of the above points). They use good spelling, punctuation and grammar and form and style are of a high standard.	[5]–[6]
Candidates use some appropriate specialist terms to describe how a heart attack occurs (using three **or** four of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates describe how a heart attack occurs. However, the description is not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

12

6 **(a)** **(i)** DNA [1]

(ii) Two nuclei or two cells drawn;
Two chromosomes in each;
identical chromosomes to parent in each; [3]

(b) **(i)** Punnett square;
Hh;
hh;
correct cross; [4]

	H	h
h	Hh	hh
h	Hh	hh

(ii) 50:50/1:1 [1]

(c) Cross with homozygous recessive/wrinkled;
Any wrinkled offspring – then parent was heterozygous;
All offspring smooth – then parent was homozygous; [3]

12

7 **(a)** In the blood; [1]

(b) **Indicative content**

- Day 1–5 lining breaks down/wall breaks down
- Day 1–5 hormone levels low

- Hormone level increases after day 5 or 6
- Hormone reaches a peak at day 11, 12, 13 or just before ovulation

- The hormone levels drop after ovulation
- On day 14 an egg is released from the ovary
- Oestrogen made in ovaries

- After day 14 egg moves down oviduct/Fallopian tubes
- Uterus lining built up after 5/6 to day 16

Response	Mark
Candidates use appropriate terms throughout and give at least five points from the indicative content (to include at least two links b/w hormone levels from the graph and two events in the menstrual cycle) to describe and account for the events of the menstrual cycle. They use good spelling, punctuation and grammar. Form and style are of a high standard.	[5]–[6]
Candidates use some appropriate terms throughout and give 3 or 4 points from the indicative content (to include at least one link b/w hormone levels and the menstrual cycle) to describe and account for the events of the menstrual cycle. They use satisfactory spelling, punctuation and grammar. Form and style are of a satisfactory standard.	[3]–[4]
Candidates give one or two points to partially describe/or account for the events of the menstrual cycle. They use limited spelling, punctuation or grammar skills.	[1]–[2]
Response not worthy of credit.	[0]

[6]

(c) **(i)** The man's sperm is added directly to the eggs; in the Petri dish; [2]

(ii) To make sure that they are healthy/growing properly; [1]

(iii) Any **two** from:

- How long should the embryos be stored?
- Who owns/has rights to the embryos/donor embryos?
- Spare embryos may be disposed of/destroyed
- Parents may wish to select, e.g. gender of the child
- Should spare embryos be used for research?
- Religious reasons [2]

AVAILABLE MARKS

12

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			AVAILABLE MARKS
8	**(a)**	Only one parent/all offspring are identical; [1]	
	(b)	**(i)** Tissue culture; [1]	
		(ii) Any **two** from: • Large leaves/large fruit/high yield • Colour of fruit/texture • Hardiness/frost resistant • Disease resistance **or** any appropriate response [2]	
		(iii) No variation/all susceptible to the same diseases; [1]	5
9	**(a)**	Brown rabbits are better camouflaged/white rabbits are more easily seen; More brown rabbits survive/white rabbits are eaten; More brown rabbits reproduce/breed; Brown rabbits pass on their genes/alleles; [4]	
	(b)	Any **two** from: • **More** snow/so that it is paler/return to grassland/paler crop • Disease in foxes/decrease in rabbit predators/increase of predators of the fox • Disease in **brown** rabbits [2]	6

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					AVAILABLE MARKS
10	**(a)**	**(i)**	TAG; Gly;	[2]	
		(ii)	153;	[1]	
		(iii)	Any **two** from: • (Triplet) code would change; • Gly not made/amino acid will be different • Different protein formed	[2]	
	(b)	**(i)**	Plasmid/with label; Gene correctly joined and labelled; All within bacterial cell;	[3]	
		(ii)	The bacteria multiply/replicate;	[1]	
		(iii)	Any **two** from: • Less side effects/it's human insulin/not from cattle • Can produce large quantities of insulin • Cheaper • Quicker • Avoids the use of animal products	[2]	
	(c)	**(i)**	Any **two** from: • The child has to receive one C.F. allele • one from each parent • It is homozygous recessive	[2]	
		(ii)	Any **two** from: • Risk of miscarriage • Should they terminate the pregnancy? • e.g. if they know the child has cystic fibrosis – is it right to bring this child into the world?	[2]	
		(iii)	Down syndrome	[1]	16
				Total	**90**

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Rewarding Learning

General Certificate of Secondary Education
2013

Double Award Science: Biology

Unit B2

Higher Tier

[GSD42]

WEDNESDAY 5 JUNE, AFTERNOON

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.

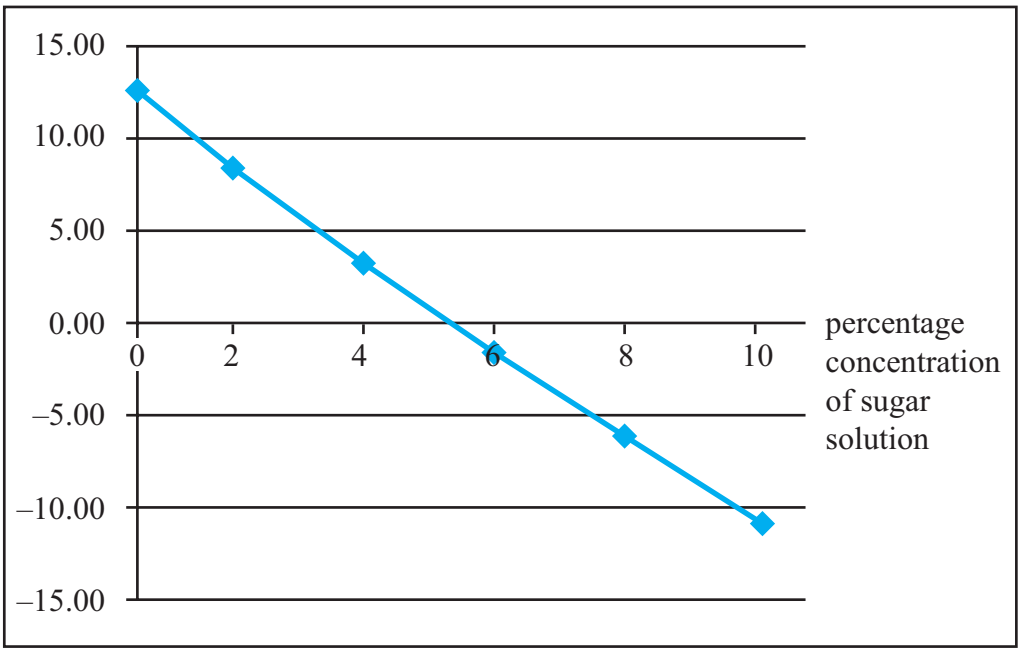
The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

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)	Blood passes through the heart twice; for one circuit of the body; [2]	
		(ii)	X – pulmonary artery; Y – hepatic vein; [2]	
	(b)	(i)	Cholesterol/fat/atheroma [1]	
		(ii)	Lack of or NO oxygen/glucose; Less respiration/less energy; Heart (muscle) cells die/heart **muscle** dies; Any **two** [2]	
		(iii)	10 times the risk; [1]	
		(iv)	Reduce the risk from 4 to 2 times/half the risk/50% less; [1]	
	(c)		Brain; [1]	10
2	(a)	(i)	Change in mass = –0.7; Percentage change in mass = **(–0.7/6.7)**; × **100 = –10.4%)**/–10.44% [3]	
		(ii)	**Initial/Starting** masses were different/easier to compare; [1]	
	(b)	(i)	Plotted correctly (5 or 6 points = [2]; 3 or 4 points = [1]); Line drawn; [3]	



		(ii)	Concentration of sugar solution from graph = 5.4%; – **from their graph** Explanation: No change in **mass**/concentration of sugar solution inside the carrot = same as concentration of sugar solution outside/ no movement of water/no osmosis [2]	9

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				AVAILABLE MARKS
3	(a)	(i)	Aseptic; [1]	
		(ii)	To **destroy** bacteria present on the loop/sterilise; [1]	
		(iii)	To prevent bacteria escaping from Petri dish/prevent bacteria from getting in from the air; [1]	
		(iv)	To stop **pathogens/harmful/dangerous** bacteria growing; [1]	
	(b)	(i)	Antibiotic C; largest area with no growth of bacteria/largest clear area/killed most bacteria; [2]	
		(ii)	Antibiotics treat **bacterial** infections; flu is caused by a **virus**; [2]	8

4 **(a)** To prevent evaporation from surface of water/of water **from the flask**/beaker/water can **only** be lost through the leaves; [1]

(b) **Indicative content:**

- Record the mass of the apparatus containing the plant **initially**/**at start**
- Leave for a given time
- Record mass at end/change in mass
- **Divide** change in mass **by time** (to work out rate)
- A named variable constant – temperature/humidity/wind speed/same (type/species) plant
- Repeat with reduced surface area/remove leaves/use plant with less/larger/smaller leaves
- Repeat for reliability/to obtain averages
- Keep **another** variable constant – temperature/humidity/wind speed/light/same type/species of plant

Response	Mark
Candidates must use appropriate specialist terms throughout to describe how they would use this apparatus and explain in logical sequence how to compare the rate of water uptake for a plant with a large surface area and then a reduced surface area (using **five or more** of the above points). They use good spelling, punctuation and grammar and form and style are of a high standard.	[5]–[6]
Candidates use some appropriate specialist terms to describe how they would use this apparatus and explain in logical sequence how to compare the rate of water uptake for a plant with a large surface area and then a reduced surface area (using **three or four** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give some explanation of how they could use this apparatus, using **at least one** of the above points. However they are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6]

				AVAILABLE MARKS
	(c)	Must have increase/decrease **with correct link to surface area** Greater water uptake/loss in mass for plant with larger surface area of leaves; or converse **more** evaporation/**more** transpiration of water/**more** stomata/**more** pores; or converse	[2]	
	(d)	Line on graph = greater gradient; still starts at zero;	[2]	
	(e)	Humidity/wind;	[1]	12
5	**(a)**	To destroy any existing bacteria/sterilise broth; (microbes, microorganisms ok)	[1]	
	(b)	No bacteria in the broth/broth uncontaminated; bacteria trapped in swan neck/get trapped in bend/can't travel against gravity;	[2]	
	(c)	(Louis) **Pasteur**;	[1]	4
6	**(a)**	Dark moths are camouflaged/poor camouflage for pale moths/not easily seen; dark moth survives or not eaten/not predated upon; reproduces/mating/produce offspring; passes on dark allele/passes on gene; **or** Allow: – **pale** more easily seen – eaten – don't reproduce – don't pass on gene	[4]	
	(b)	Increase/goes up;	[1]	
	(c)	Die out/become extinct/endangered; – must refer to population not just individual	[1]	6
7	**(a)**	Use a condom/abstinence/don't share needles/don't use dirty needles/ use sterilised needles; Athlete's foot; Bacteria; Airborne droplet infection/in the air/breathing in/airborne/sneezing/ coughing;	[4]	
	(b)	Blood clotting – prevents microorganisms from entering (a cut); (Ignore blood loss) Mucous membrane – traps microbes/microbes get stuck/catches microbes; Phagocytosis – engulfs/surrounds; and digests/breaks down microorganisms;	[4]	

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(c) Any **four** from:
- Antibodies are specific/are complementary to A
- Cause the bacteria (A) to clump together
- Prevents microorganisms dividing/reproducing/moving around body/spreading/immobilises/allows action of phagocytes
- Antibodies not a match for (antigens on) B/don't fit B, not specific for B
- Antibodies attach to **antigen** [4]

(d) **(i)** Any **two** from:
- larger number **antibodies** produced/brings above threshold for immunity
- antibodies remain for longer/takes longer to drop below threshold for immunity/gives long term immunity/it's long lasting antibodies/immunity
- antibody levels rise quicker [2]

(ii) Jenner; [1]

AVAILABLE MARKS

15

8 **(a)** **(i)** Lining shed/breaks down/leaves body; [1]

(ii) Uterine wall starts to thicken/build up; [1]

(b) Day 10–14 shaded;
Only Day 9 + 15 shaded in addition to 10–14; [2]

(c) **(i)** Mistake in counting days/irregular cycle/described/ovulation may not always occur on day 14; [1]

(ii) Religious reasons/object to taking tablets/latex allergy/no side effects/ethical/moral; [1]

(d) **(i)** Circle around number 21 chromosomes **or** one No. 21; [1]

(ii) Has two X chromosomes/XX/no Y chromosome; [1]

(iii) Risk of miscarriage/she would not have an abortion/against abortion/care + love baby anyway; [1]

(e) **(i)** Arrow from placenta towards baby; [1]

(ii) Useful – glucose/amino acids/antibodies/fatty acids/glycerol/vitamins/minerals/water/hormones; [1]

(iii) Urea/carbon dioxide; [1]

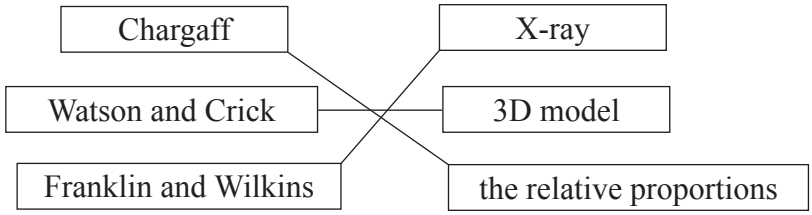
(iv) Increases surface area; [1]

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	AVAILABLE MARKS

9 (a)



3 correct = [2], 1 correct = [1] [2]

(b) (i) Circle around nucleotide (1 base, 1 sugar, 1 phosphate linked together); [1]

(ii) Need to keep strands parallel/distance between strands not uniform/ too big/won't fit in space; [1]

(c) (i) Double helix; [1]

(ii) C = 30%;
T = 20%; [2]

(d) Indicative content

- **Gene** for insulin removed (from human chromosome)
- Plasmid removed from bacterium
- Plasmid cut open
- Insulin **gene** inserted
- Plasmid reinserted into bacterium
- Bacteria multiply/clone/mitosis

Response	Mark
Candidates must use appropriate specialist terms throughout to describe the steps involved in genetic engineering of insulin (using **five or more** 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 to describe the steps involved in genetic engineering of insulin (using **three or four** of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates give some description of the steps involved in genetic engineering of insulin. However they are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 13

Total **90**

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