



General Certificate of Secondary Education
2015

Centre Number

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Candidate Number

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**Double Award Science:
Biology**

Unit B2
Higher Tier

[GSD42]

MV18

FRIDAY 5 JUNE, AFTERNOON

TIME

1 hour 15 minutes, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

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

You must answer the questions in the spaces provided.

Complete in blue or black ink only.

Answer **all eleven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **90**.

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

Quality of written communication will be assessed in Questions **2** and **6(e)**.

- 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.
[8 marks]

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		

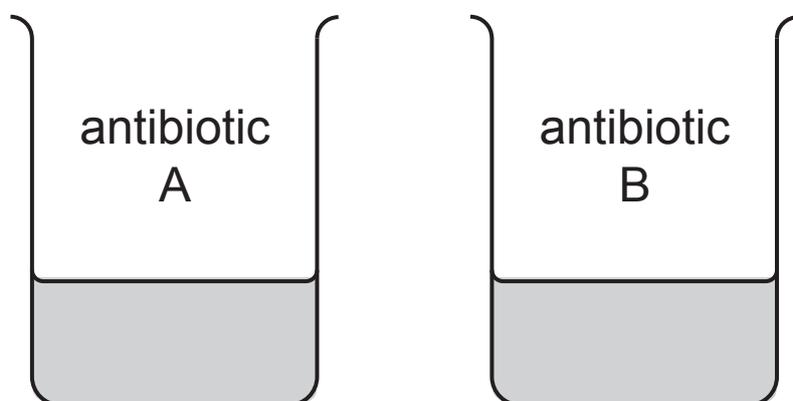
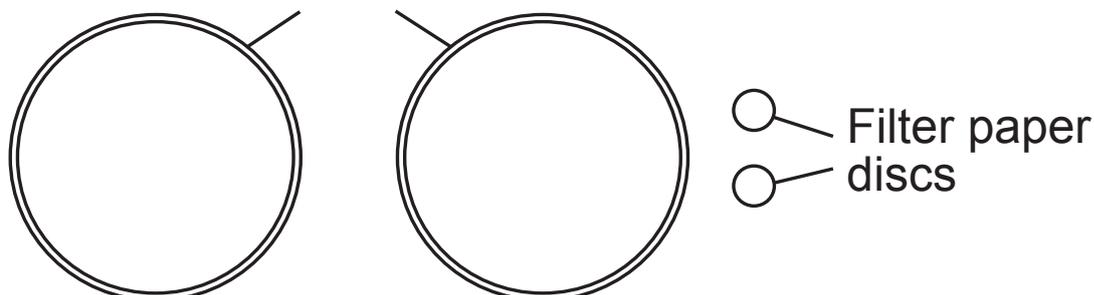
2 A student wanted to investigate how effective two antibiotics were against a particular type of bacteria.

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.

petri dishes containing nutrient agar inoculated with bacteria

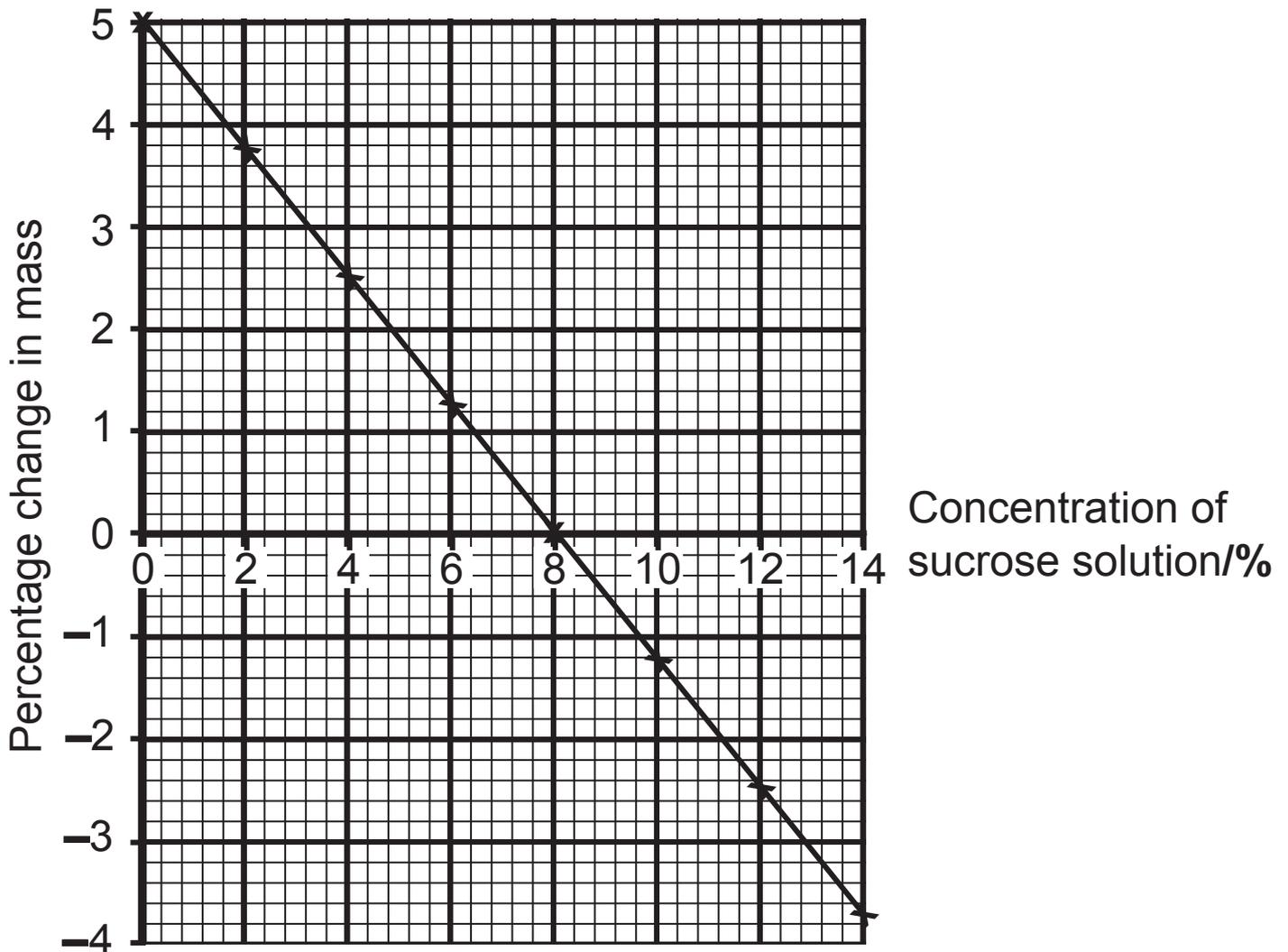


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(Questions continue overleaf)

- 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 on page 6 to find the percentage concentration of sucrose solution which gives zero percentage change in the mass of the potato cylinder. [1 mark]

_____ %

(ii) Explain your answer. [1 mark]

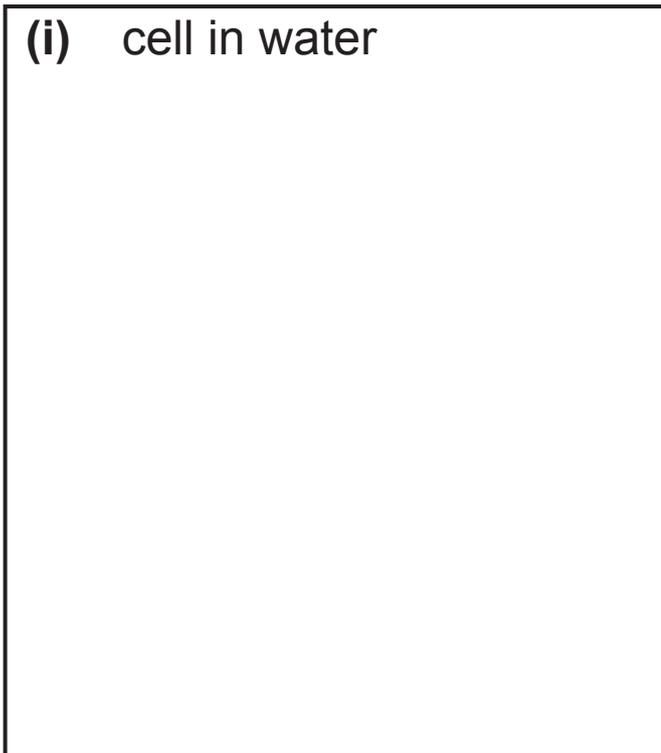
(b) Draw a plant cell in each box as it would appear after it had been left for 2 hours in [4 marks]

(i) water (0% sucrose solution).

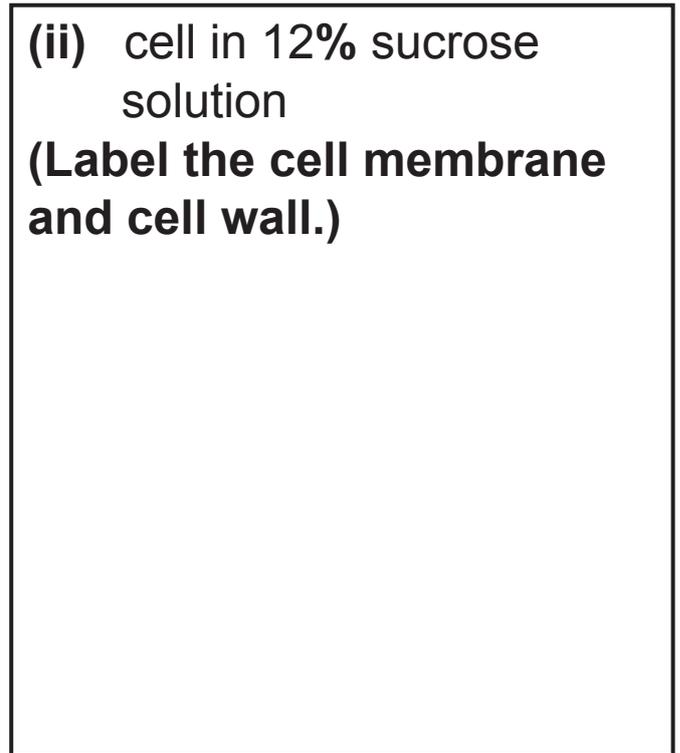
(ii) 12% sucrose solution.

Label the cell wall and cell membrane.

(i) cell in water



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



(c) What is the function of the plant cell wall in osmosis?
[1 mark]

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

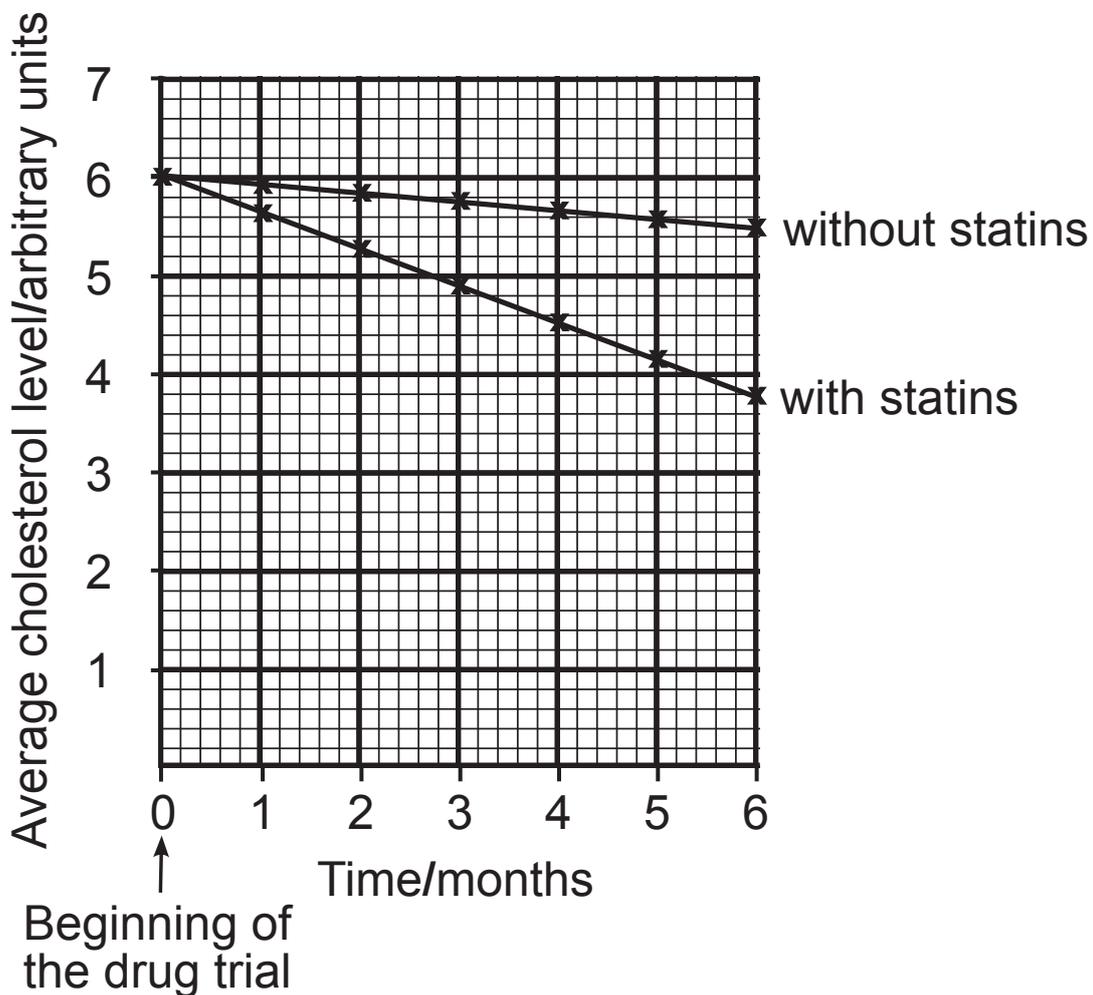
(a) Explain how a high cholesterol level in the blood can lead to a heart attack. [4 marks]

(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.



- (i) What conclusions can be drawn from this drug trial?
Use data from the graph on page 10 to support your answer. [3 marks]

- (ii) Why was the group of patients who were **not** given statins included as part of the trial? [1 mark]

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?
[2 marks]

Show your working

_____ women

(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.

[2 marks]

1. _____

2. _____

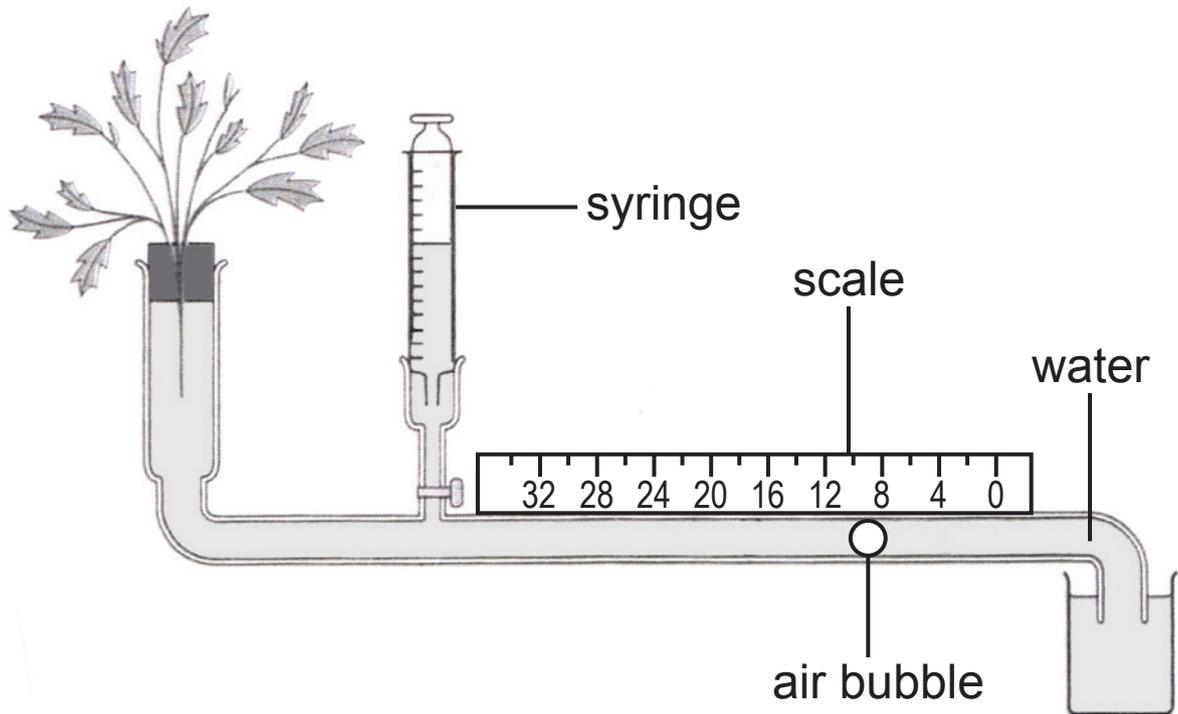
(b) The plasmid containing the insulin gene is placed back into a bacterium.

Explain how this genetically engineered bacterium can be used to produce large quantities of insulin in a short period of time. [1 mark]

(c) State **two other** advantages of producing human insulin by this method. [2 marks]

(d) Name the condition that insulin is used to treat. [1 mark]

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



- (i) Name the apparatus. [1 mark]

- (ii) How is the bubble reset to zero between experiments? [1 mark]

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(Questions continue overleaf)

(b) The table below 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			
1	off	20	low		4
2	on	20	low		6
3	off	30	low		
4	on	30	low		9

Complete the table on page 18 by

- (i) drawing in the position of the air bubble at the end of Experiment 2. [1 mark]
 - (ii) calculating the distance moved by the air bubble in Experiment 3. [1 mark]
- (c) What is the rate of transpiration in Experiment 1 in mm **per hour**? [1 mark]

_____ mm per hour

- (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 mark]

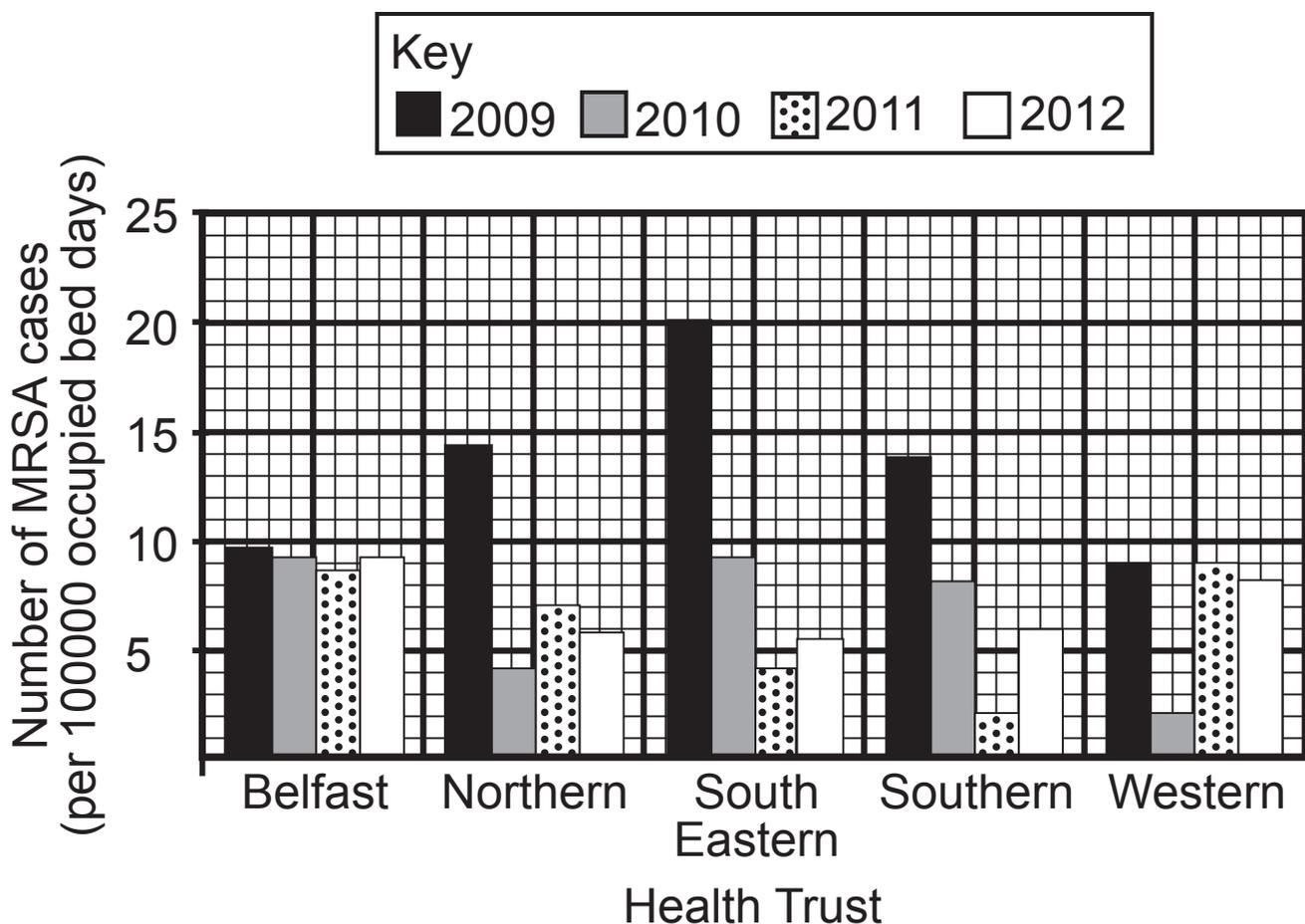
- (ii) Experiment 1 was repeated with high humidity. What would you expect to happen to the distance moved by the bubble? [1 mark]

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 mark]

(ii) Explain what is meant by the term 'resistant to antibiotics'. [1 mark]

(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.



- (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 on page 21 to complete the table for the Western Trust. [1 mark]

	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			

- (ii) Use the information in the table to give the Health Trust that shows the same trend as the Western Trust. [1 mark]
-

(iii) Use the information in the graph on page 21 to calculate the percentage decrease in MRSA cases between **2009 and 2011** for the **South Eastern Trust**. [2 marks]

Show your working

_____ %

(iv) Suggest **two** ways that staff in the hospitals in this Health Trust could have brought about this decrease in MRSA cases. [2 marks]

1. _____

2. _____

8 The photographs show strawberry plants and sunflowers.



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

(i) What is a clone? [1 mark]

The clones were not exactly the same height.

(ii) Suggest why the cloned strawberry plants were **not** exactly the same height. [1 mark]

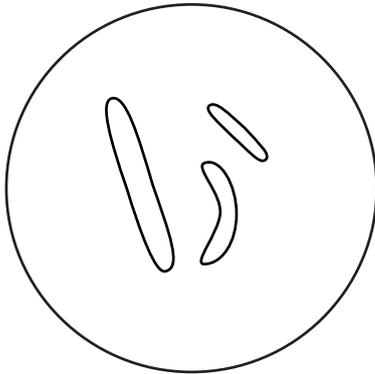
(iii) What type of cell division occurs as plants grow? [1 mark]

(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 mark]

(ii) What **type** of variation is shown by the heights of the offspring sunflowers? [1 mark]

- 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 marks]

- (b) (i) Name **one** part of the human body where meiosis takes place. [1 mark]

(ii) How many haploid cells are produced from one cell during meiosis? [1 mark]

(iii) Human eggs and sperm each contain 23 chromosomes.

Explain the significance of this during fertilisation in terms of chromosome numbers. [1 mark]

(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.
[3 marks]

Franklin and Wilkins

Chargaff

Watson and Crick

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. [2 marks]

1. _____

2. _____

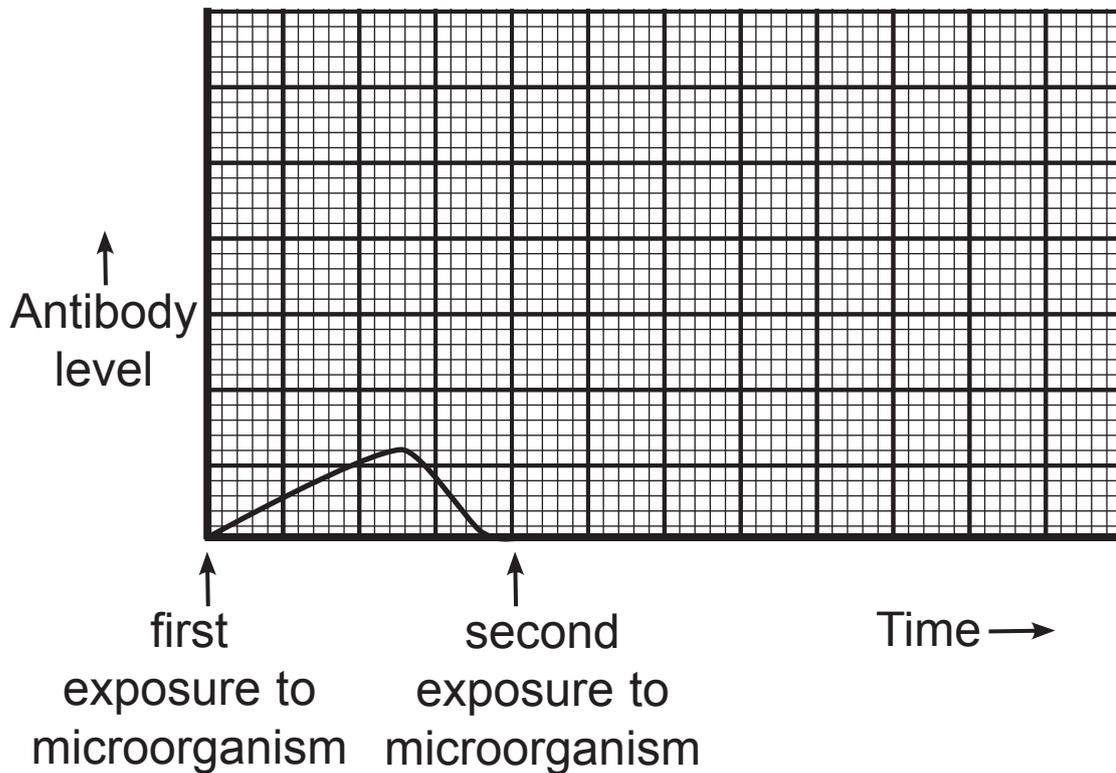
(b) If microorganisms such as bacteria do get into the body, the body responds by producing antibodies.

Describe how the presence of a specific microorganism results in the production of antibodies. [2 marks]

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

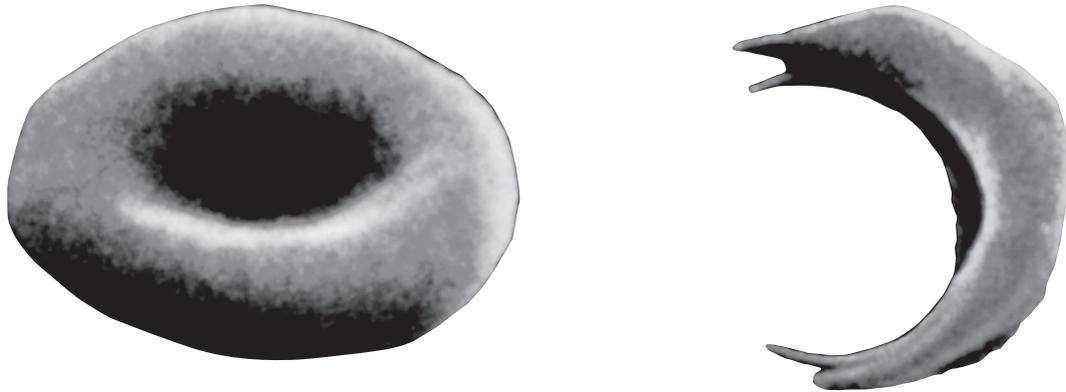
On the graph, draw a line for the time period given to show the antibody level that you would expect.

[3 marks]



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.



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 marks]

(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 mark]

(ii) Suggest the benefit **to the NHS** of only screening the father if the mother is a carrier for sickle cell anaemia. [1 mark]

SOURCES

Pg 16 Q6(a) Diagram showing apparatus used to investigate the rate of transpiration in a plant shoot © GCSE Biology for CCEA, 2nd Edition by James Napier, Hodder Education (2011). ISBN: 9780340983805. Reproduced by permission of Hodder Education.

Pg 21 Q7(b) Graph comparing the number of MRSA cases in hospitals for the first three months of each year from 2009-2012

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

Pg 25 Q8 Photograph of strawberry plants © Simon Fraser / Science Photo Library

Pg 25 Q8 Photograph of sunflowers © Dr Neil Overy / Science Photo Library

Pg 33 Q11 Diagram showing sickle cell anaemia © Mary Martin / Science Photo Library

For Examiner's use only	
Question Number	Marks
1	
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Total Marks	
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Examiner Number

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