Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

# Double Award Science: Biology

Unit B2
Higher Tier

ML

## [GSD42]

## 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.**
**Do not write outside the boxed area on each page or on blank pages.**
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 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)**.

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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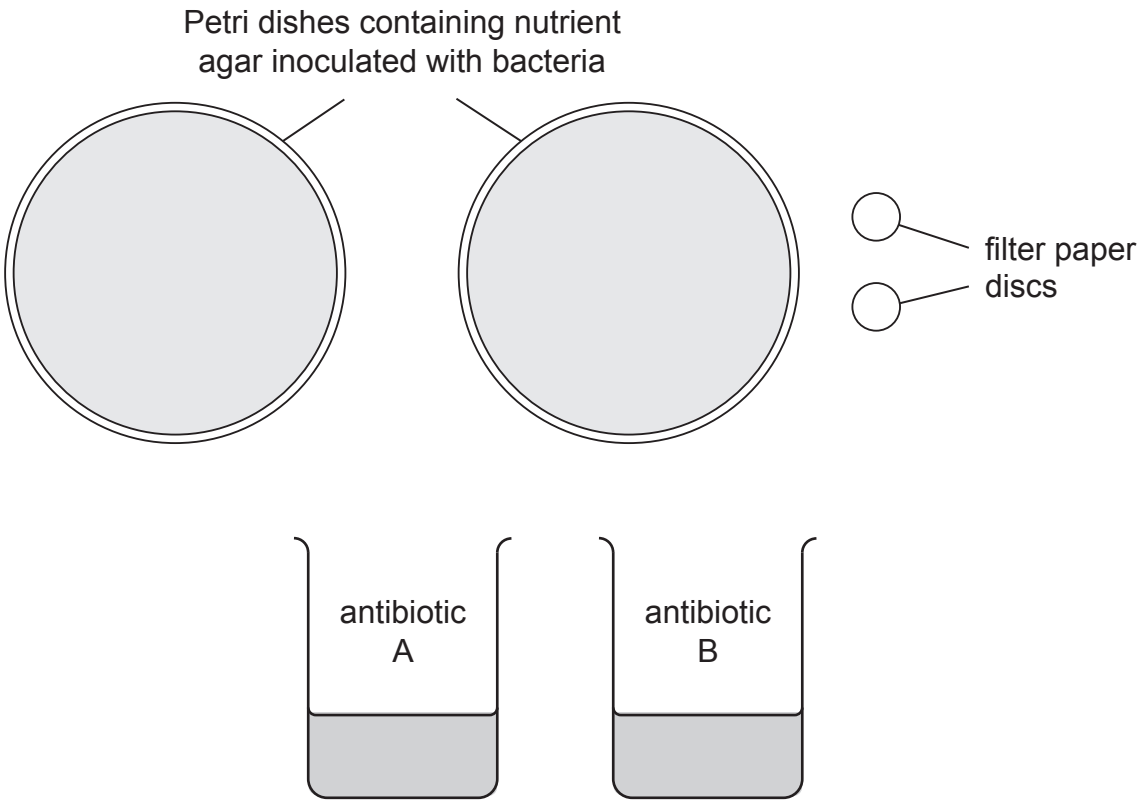
**(Questions continue overleaf)**

**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.



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.

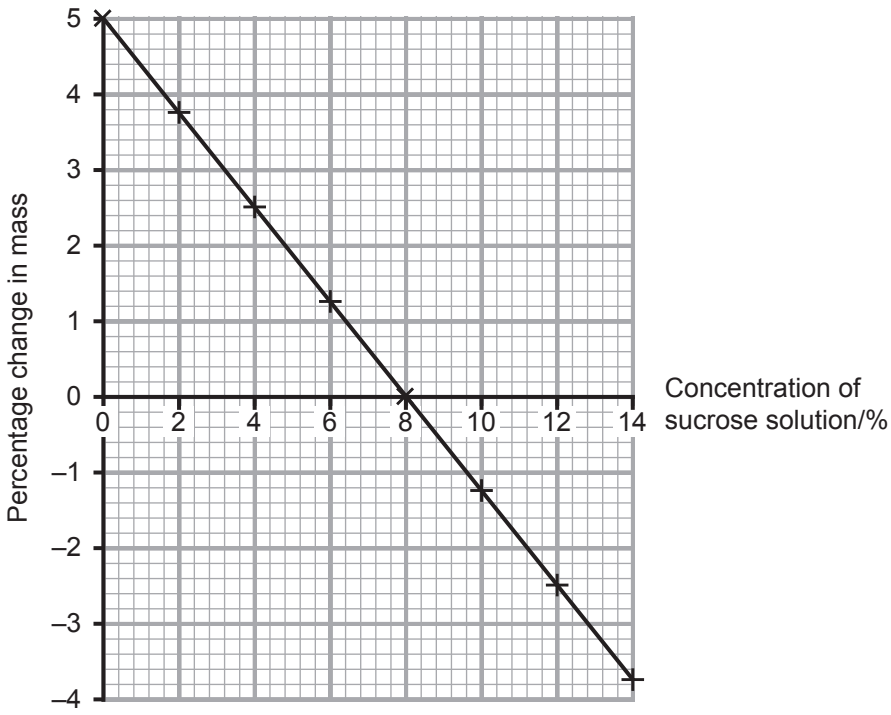
**In this question you will be assessed on your written communication skills including the use of specialist scientific terms.**

[6]

**[Turn over**

**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]

**(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**

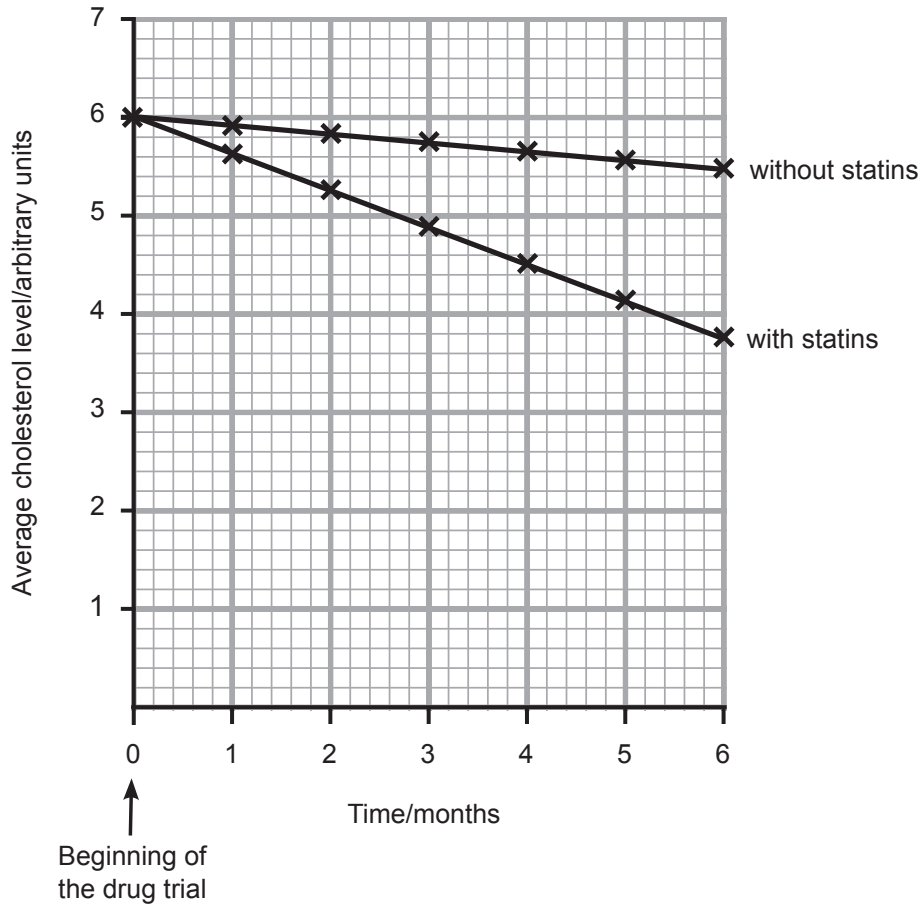
**4** A high cholesterol level in the blood increases the risk of a heart attack.

**(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.



**(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 out.**

women [2]

**[Turn over**

**(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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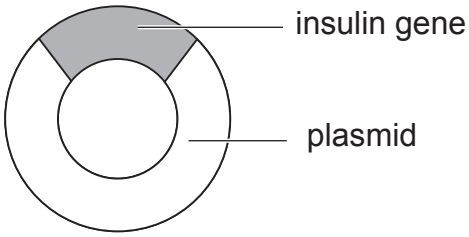
**(Questions continue overleaf)**

**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]

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

_____

_____

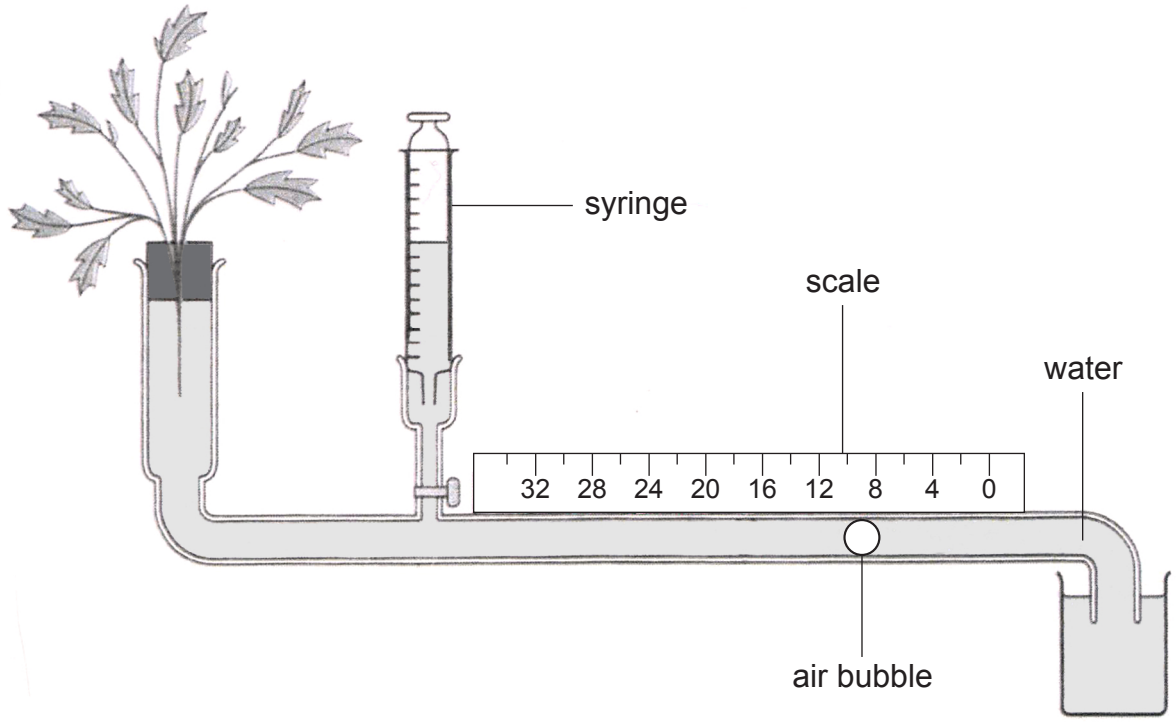
_____ [2]

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

_____ [1]

**[Turn over**

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]

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

_____

_____ [1]

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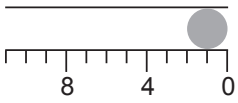
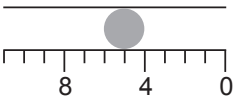
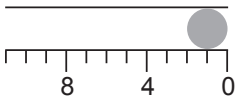
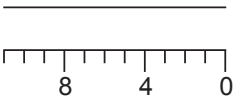
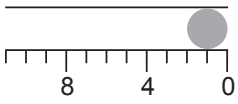
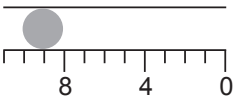
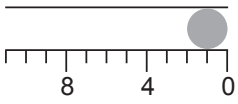
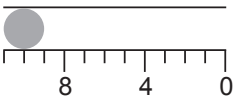
**(Questions continue overleaf)**

**(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]

**(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**

**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?

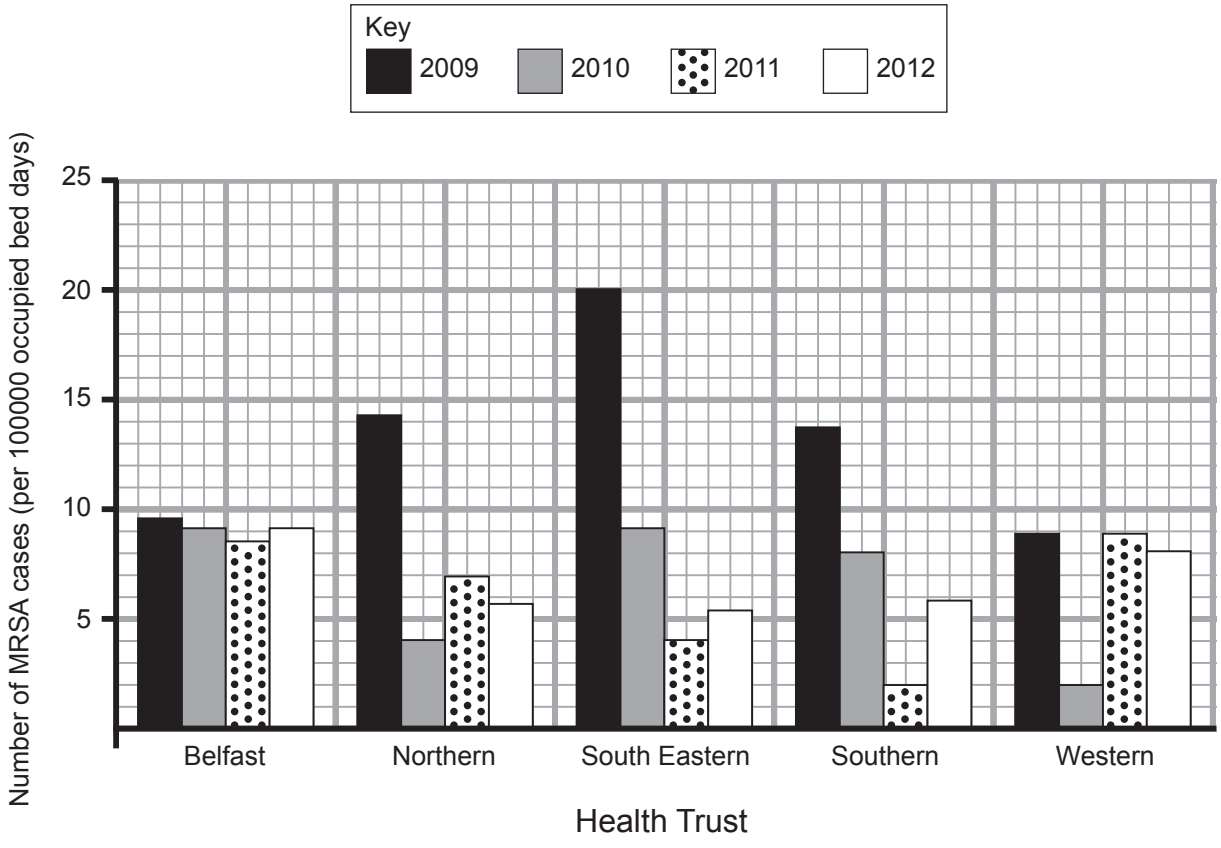
_____ [1]

**(ii)** Explain what is meant by **resistant to antibiotics**.

_____

_____ [1]

**(b)** Look at the graph below. It 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'.*

**(i)** Look at the table below. It shows 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 out.**

_____ % [2]

**[Turn over**

**(iv)** Give **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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**(Questions continue overleaf)**

**8** Look at the photographs below. They 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]

**(b) (i)** The sunflower plants reproduced by sexual reproduction. After they had grown, the offspring had many different heights.

Explain the reason for this variation in height.

_____

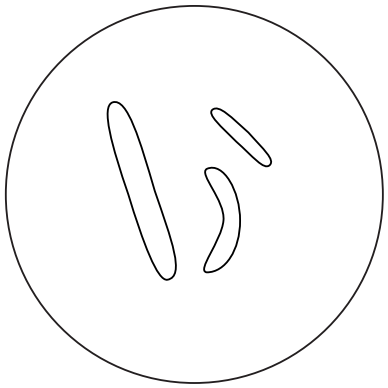
_____ [1]

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

_____ [1]

**[Turn over**

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



In the space below 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]

**(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**

**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.

_____

_____

_____

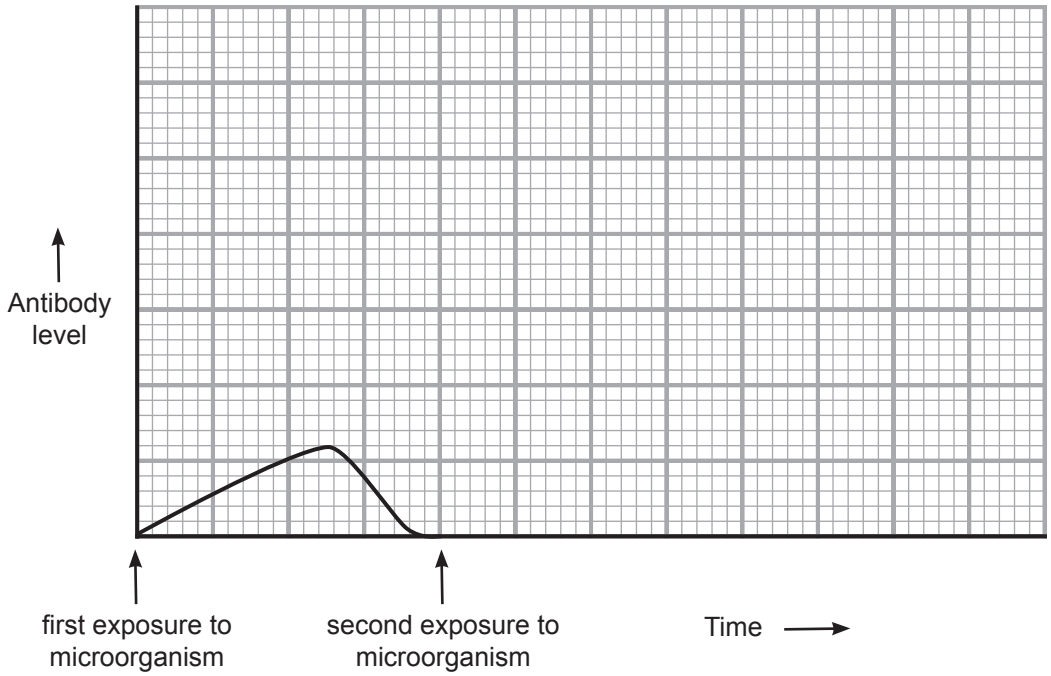
_____

_____

_____ [2]

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

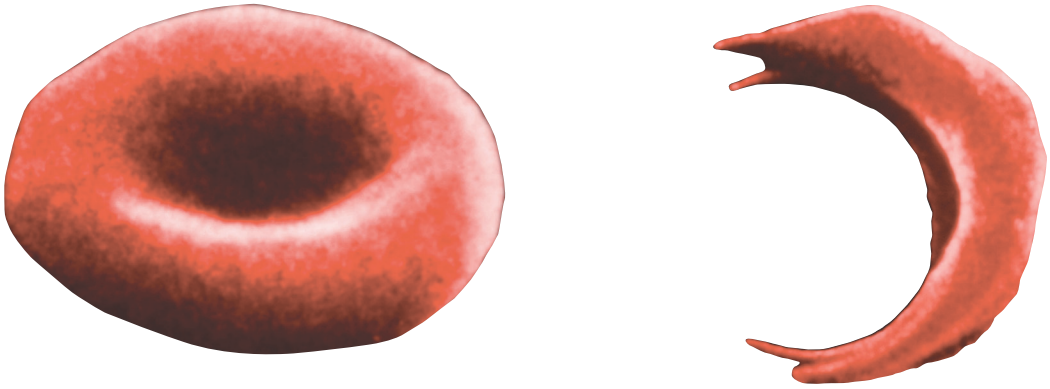
On the graph, draw a line for the time period given to show the antibody level that you would expect.




[3]

**[Turn over**

**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]

**(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**

[3]

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| Question Number | Marks |
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