Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017

# Double Award Science: Biology

Unit B2

Higher Tier

**[GSD42]**

**FRIDAY 9 JUNE, MORNING**

**ML**

## 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 black ink only.
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 **2(a)(i)** and **6(a).**

**1** **(a)** The World Health Organisation (WHO) has published some facts about sexually transmitted infections (STIs).

They are listed below.

- Worldwide, more than one million people get a sexually transmitted infection (STI) every day.
- The majority of people with STIs have no symptoms.
- STIs such as gonorrhoea and chlamydia are major causes of infertility.

**(i)** A person has been infected with a STI.

Use **only the facts listed above** to suggest why this person may choose **not** to go to a doctor to be diagnosed with the STI.

_____

_____ [1]

**(ii)** Another person has the symptoms of a STI.

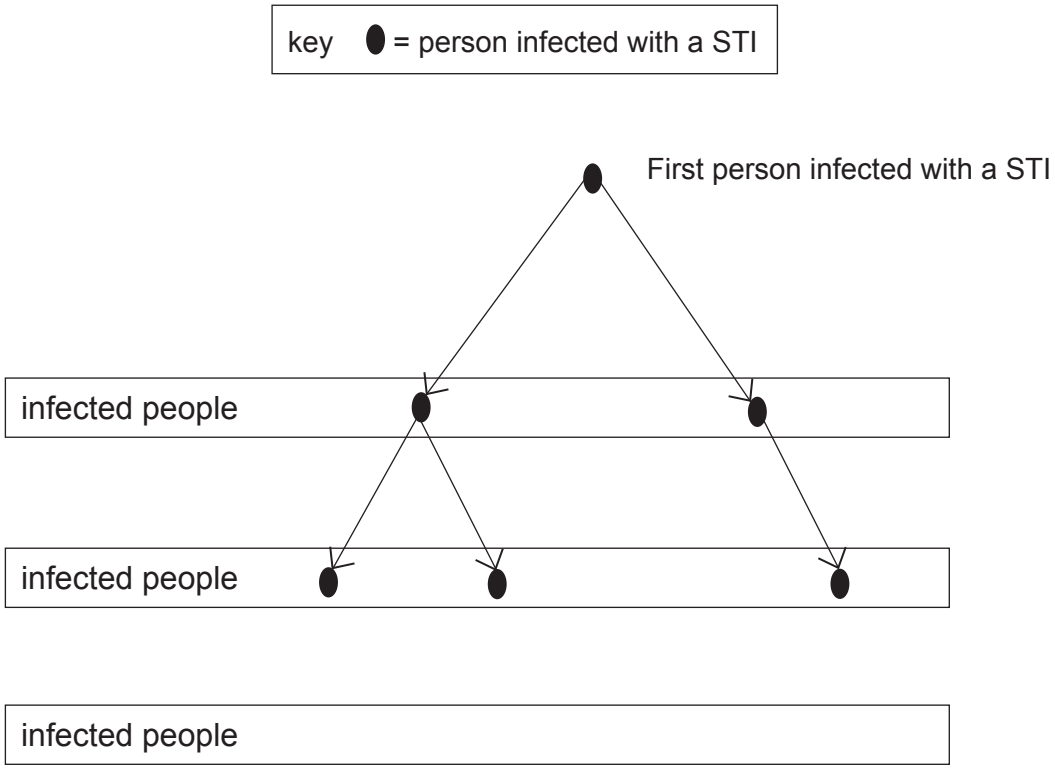
Suggest why this person may choose not to go to a doctor to be treated for the STI.

_____

_____ [1]

**(b)** A person infected with a STI can pass the STI on to other people.

**(i)** Complete the diagram to show the sequence of infection if each infected person has two sexual partners.




[2]

The first person passes on the STI.

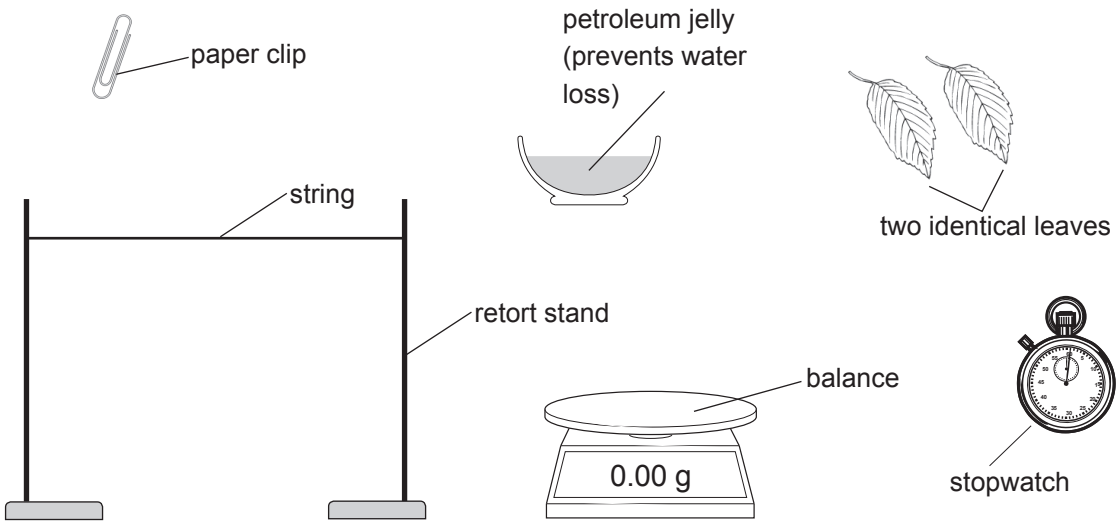
**(ii)** Use the diagram to state how many **more** people will be infected with this STI.

_____ [1]

**[Turn over**

**2** **(a)** Fiona did an investigation in the laboratory. She compared the **rate** of water loss from the upper surface of one leaf with the **rate** of water loss from the lower surface of a second, identical leaf.

The diagram shows the apparatus and materials she was given.






**(i)** Describe how Fiona would set up and carry out her investigation.

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

[6]

[Turn over

**(ii)** Fiona would need to control humidity during her investigation.
Name **two** other factors Fiona would need to control.

1. _____

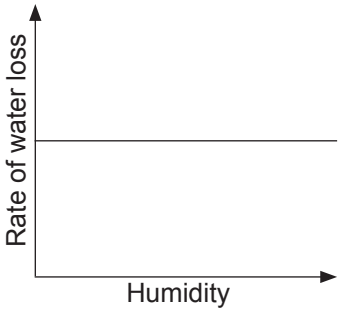
2. _____ [2]

**(iii)** Water is lost through the pores in leaves.
What are these pores called?

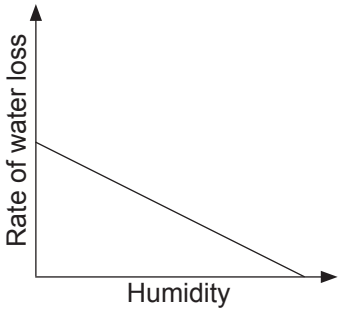
_____ [1]

**(b)** Which of the graphs, **A**, **B** or **C**, shows the rate of water loss if the humidity around a plant **increases**?

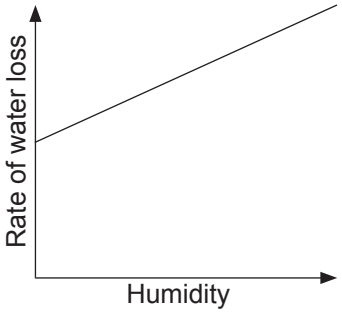
Graph **A**




Graph **B**




Graph **C**




Graph _____ [1]

**(c)** Give **two** uses of water in plants.

1. _____

_____

2. _____

_____ [2]

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**(Questions continue overleaf)**

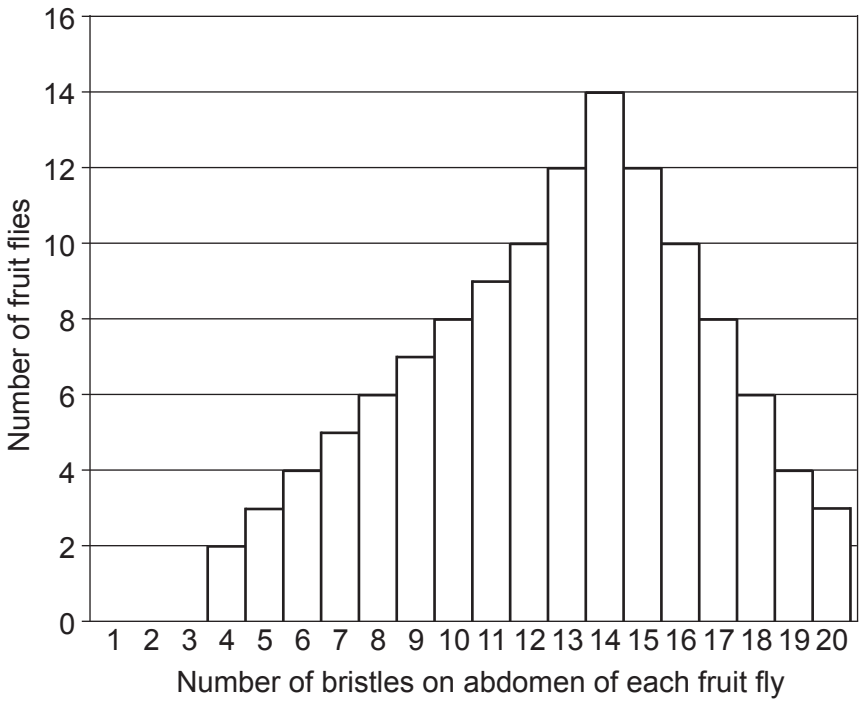
**3** **(a)** Fruit flies are often used in genetic studies.

The photograph below shows a fruit fly.
Fruit flies have bristles (small hairs) on their abdomens.
These bristles act as touch sensors.

*© Thomas Deerinck / Science Photo Library*

In a study of fruit flies the number of bristles on the abdomen of each fly was counted.

The graph shows the results of the study.




*Adapted from © Drosophila bristles and the nature of quantitative genetic variation by Trudy F.C Mackay and Richard F Lyman. Published by National Center for Biotechnology Information, July 2005*

Use the information given opposite to answer the following questions.

**(i)** What is the range of the number of bristles on the abdomens of these fruit flies?

_____ to _____ [1]

**(ii)** How many fruit flies in this study have 15 or more bristles?

**Show your working out.**

_____ [2]

**(iii)** Suggest why it is an advantage for the fruit flies to have a larger number of bristles.

_____

_____

_____

_____

_____

_____ [2]

**[Turn over**

**(b)** Most fruit flies have red eyes. Some fruit flies have purple eyes. The allele **R** for red eyes in fruit flies is dominant to the allele **r** for purple eyes.

**(i)** Fruit flies with red eyes can have two different genotypes. Give these genotypes.

_____ and _____ [2]

A fruit fly that is homozygous for red eyes is crossed with a fruit fly with purple eyes.

**(ii)** Use a Punnett square to show the genotypes of the offspring that would be produced from this cross.

[4]

**(iii)** Give the eye colour of the offspring produced by this cross.

_____ [1]

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**(Questions continue overleaf)**

**4** Matthew carried out an investigation into osmosis in potatoes.

He cut five potato cylinders and measured their lengths.
He placed one potato cylinder into each of five different concentrations of sugar solution and left them for 24 hours.
After 24 hours Matthew removed the potato cylinders, dried them and measured their lengths again.

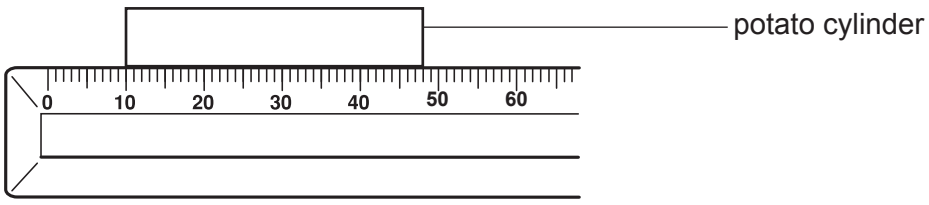
The table shows some of his results.

| Concentration of sugar solution/% | Length of potato cylinder at start/mm | Length of potato cylinder after 24 hours/mm | Percentage change in length of potato cylinder |
|---|---|---|---|
| 0 | 41 | 45 | +9.8 |
| 5 | 42 | 44 | +4.8 |
| 10 | 41 | 40 | –2.4 |
| 15 | 42 | 45 | +7.1 |
| 20 | 42 | | –9.5 |

The diagram below shows the potato cylinder after it had been left in the 20% sugar solution for 24 hours.

**(a)** **Use the ruler shown** in the diagram to measure the length of the potato cylinder.

Write your answer in the empty box **in the table**. [1]



**(b)** The result for the potato cylinder in 15% sugar solution is **anomalous**.

**(i)** How can you tell that this is an **anomalous** result?

_____

_____ [1]

**(ii)** Suggest a **reason** for this **anomalous** result.

_____

_____ [1]

**(c)** Look at the column for the percentage change in length of the five potato cylinders in the table opposite.

**(i)** Use this information to suggest a **possible** concentration of the sugar solution inside the potato used in the investigation.

Concentration inside the potato _____ % [1]

**(ii)** Explain your answer to part **(i)**.

_____

_____

_____

_____

_____

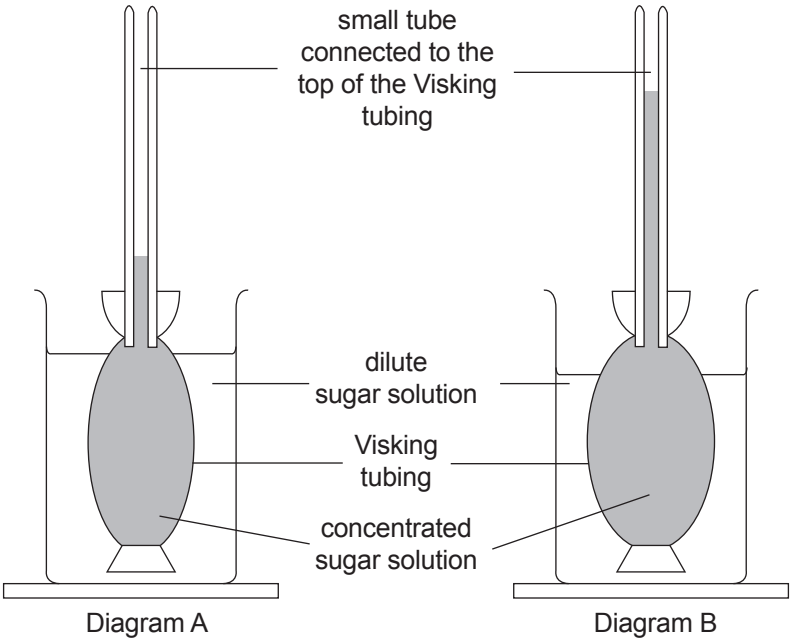
_____ [2]

**[Turn over**

**(d)** The diagrams show another osmosis experiment.

Visking tubing is selectively permeable.

- Diagram A shows the apparatus at the start of the experiment.
- Diagram B shows the apparatus **after three hours**.




*Source: Principal Examiner*

**(i)** What structure in a cell does Visking tubing represent?

_____ [1]

**(ii)** Using diagrams A and B and your knowledge, describe and explain the results **after three hours**.

Description

_____

_____

Explanation

_____

_____

_____

_____

_____

_____

_____ [3]

**[Turn over**

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**5** Polio is a disease caused by a virus.

Since 1988 the World Health Organisation (WHO) has had a vaccination programme aimed at wiping out polio worldwide.

In 1988, the number of people with polio worldwide was 350 000.

In 2014, the number of people with polio worldwide was 386.

**(a)** Calculate the **percentage reduction** in the number of people with polio worldwide from 1988 to 2014.

Give your answer to **two** decimal places.

**Show your working out.**

_____ [3]

**(b)** Afghanistan, Nigeria and Pakistan are countries that still have people with polio.

In these countries, polio vaccine is given by drops into the mouth.

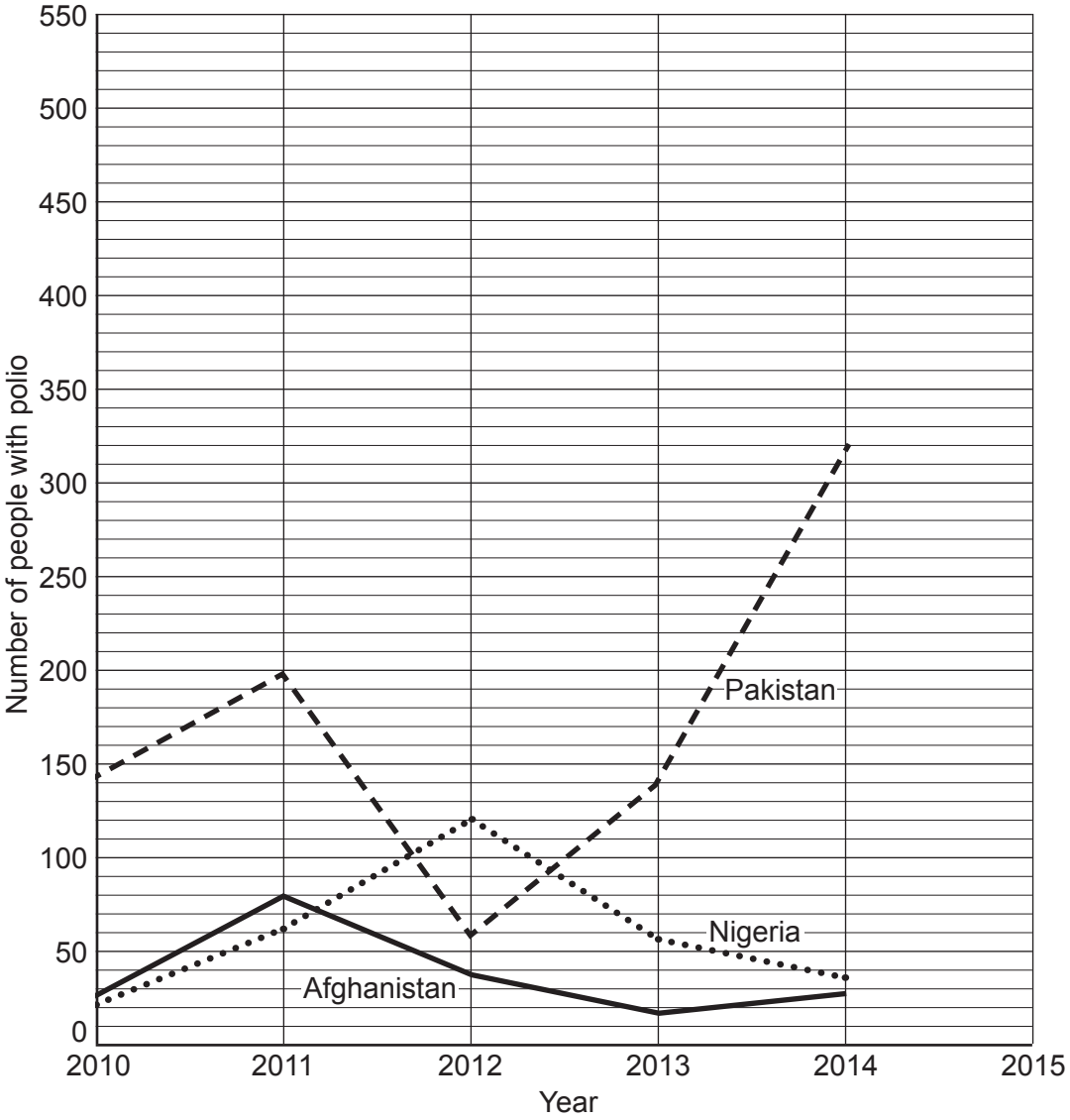
**(i)** Suggest **one** advantage of using a vaccine that can be given by drops into the mouth, rather than by injection.

_____

_____ [1]

**[Turn over**

The graph shows the number of people with polio in Afghanistan, Nigeria and Pakistan, between 2010 and 2014.



**(ii)** In which one year period is the trend in all three countries the same?

_____ to _____ [1]

**(iii)** Use the graph to give a **difference** in the trend for Nigeria and Pakistan between 2012 and 2014.

_____

_____

_____ [1]

Assume that the trend in numbers of people with polio in Pakistan **continued at the same rate** as in 2013–2014.

**(iv)** Draw a line on the graph to find the number of people with polio in Pakistan in 2015.

Give the number of people with polio in Pakistan in 2015.

Number of people _____ [2]

**[Turn over**

**6** **(a)** Vaccination is one method of protecting the body against a disease.

Sometimes a booster vaccination is given.

- State what a booster vaccination contains.
- Explain why a booster vaccination is given.
- Describe what happens in the body when a booster vaccination is given.

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

_____

_____

_____

_____ [6]

[Turn over

**(b)** Antibiotics can help treat bacterial diseases.

**(i)** Name the first antibiotic discovered.

_____ [1]

MRSA is a type of bacteria that has evolved resistance to some antibiotics.

**(ii)** Describe how natural selection has led to the evolution of antibiotic resistance in MRSA bacteria.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

In a hospital, hand sanitisers (gels) were introduced to try to reduce the incidence of MRSA in patients.

**(c)** Suggest what data the hospital would need to collect to evaluate the effectiveness of the use of hand sanitisers.

_____

_____

_____

_____

_____

_____

_____

_____ [2]

**[Turn over**

**7** The process of in vitro fertilisation (IVF) can be used to help a woman with blocked oviducts to become pregnant.

**(a)** Explain why a woman with blocked oviducts may have difficulty in becoming pregnant.

_____

_____ [1]

**(b)** The first stage in IVF begins when a woman is given fertility hormones.

**(i)** Why are fertility hormones given to the woman?

_____

_____

_____ [1]

**(ii)** On which day of the woman's 28 day menstrual cycle would the ova be removed from her ovaries?

Explain why the ova would be removed on this day.

Day _____

Explanation _____

_____ [2]

A number of embryos are formed during IVF. They are left in the culture solution in a Petri dish for three days.

**(iii)** Why are the embryos left for three days before being placed into the woman's uterus?

_____

_____ [1]

Before the embryos are placed into the woman's uterus she is given different hormones.

**(iv)** Suggest the function of the hormones given at this stage of the IVF process.

_____

_____ [1]

**(v)** There is a process that takes place when the embryos have been placed into the woman's uterus.
What is the name of the process that enables them to continue developing?

_____ [1]

**(vi)** A process occurs during the development of the embryos that produces a variety of tissues and organs.
What is the name of this process?

_____ [1]

**[Turn over**

**8** **(a)** DNA contains bases that code for amino acids.

The amino acids then combine to form proteins.

**(i)** Name the scientist who discovered the information about the relative composition of the bases in DNA.

_____ [1]

**(ii)** What technique did Watson and Crick use to work out the structure of DNA?

_____ [1]

A DNA molecule was analysed and found to contain 40.6% of the base A.

**(b)** Calculate the percentages of the other bases in this DNA molecule.

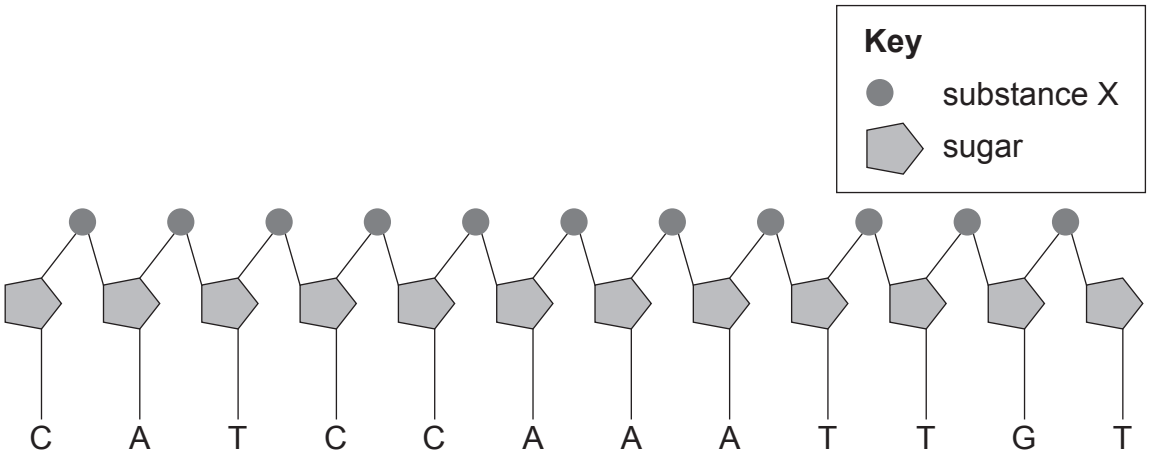
**Show your working out.**

C _____ %

T _____ %

G _____ % [3]

**(c)** The diagram shows part of a DNA molecule.






**(i)** Name the sugar in DNA. _____ [1]

**(ii)** Name substance X in DNA. _____ [1]

A hypothesis states that a sequence of three bases codes for a specific amino acid.

**(iii)** Give the name of this hypothesis.

_____ [1]

**[Turn over**

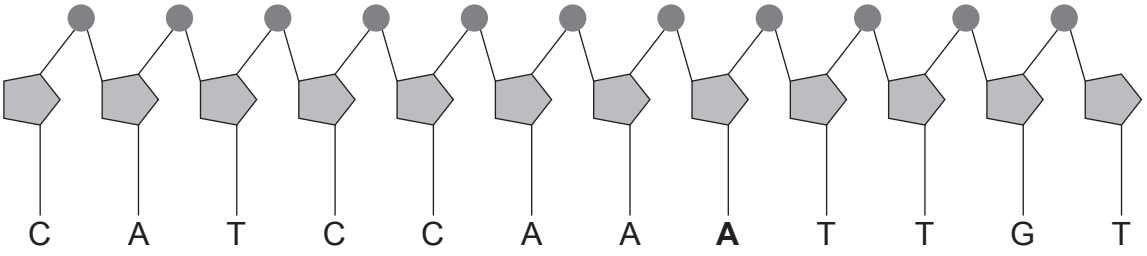
The table below gives five base sequences in DNA and the amino acids that each base sequence codes for.

| Base sequence in DNA | Amino acid coded for |
|---|---|
| AAT | Leucine |
| ATT | Isoleucine |
| CAT | Valine |
| CCA | Glycine |
| TGT | Threonine |

The diagram below shows part of a DNA molecule.

**(iv)** Use the information in the table above to name the amino acid that each base sequence codes for.

Write the names of the amino acids in the empty boxes.




| | | | |
|---|---|---|---|
| | | | |
| amino acids coded for by the base sequence | | | |



[2]

Changes can occur in the base sequence of DNA.

One of the bases, the fourth A on the diagram opposite, is replaced by the base T.

**(v)** What different amino acid would be coded for?

_____ [1]

**(vi)** What would be the result of this new amino acid sequence?

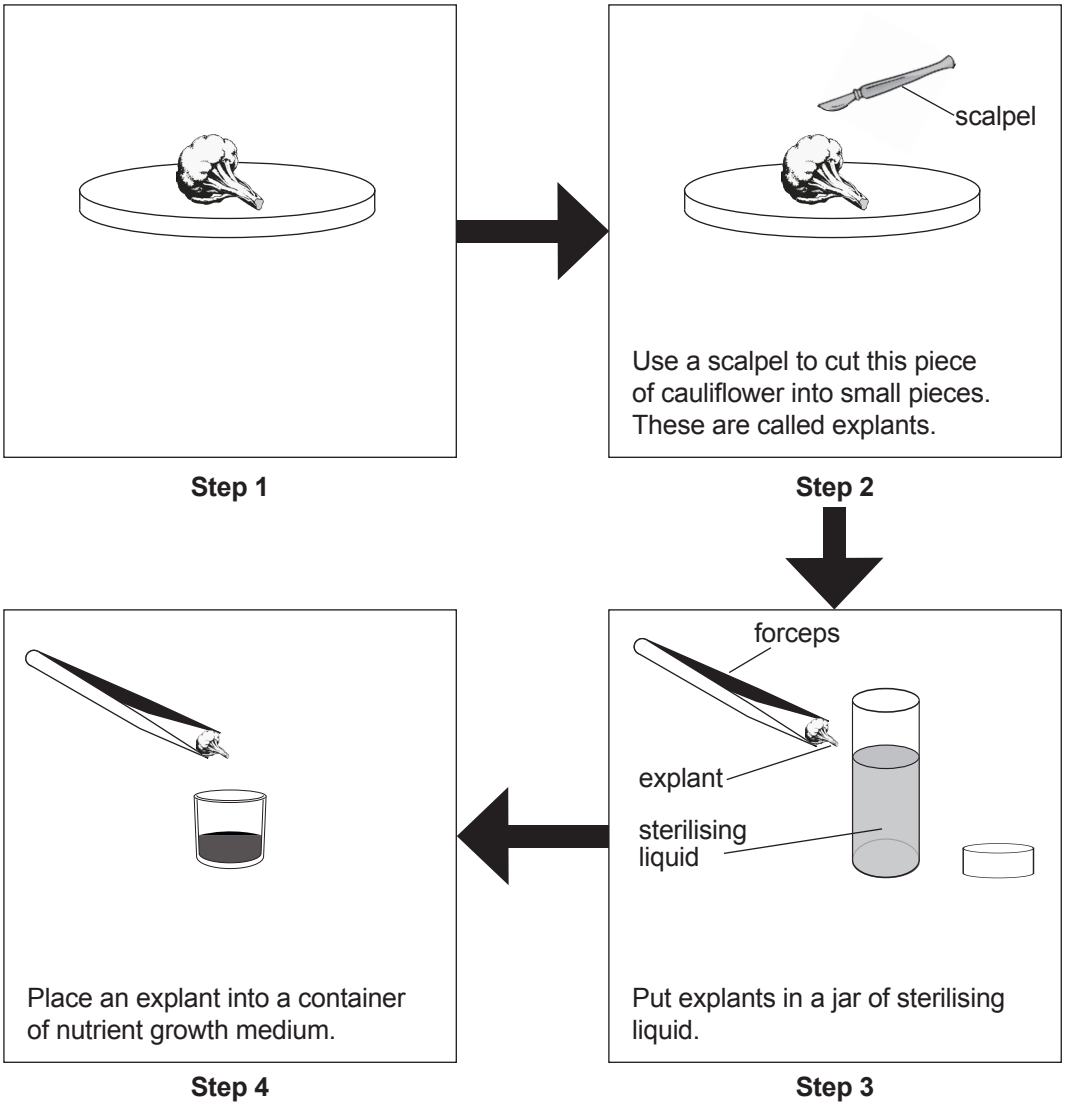
_____

_____ [1]

**[Turn over**

**9** Hannah carried out a tissue culture technique with a small piece of cauliflower.

The diagrams show the steps she used.




*Adapted from © Cauliflower Cloning - Tissue Culture and Micropropagation by Science and Plants for Schools (SAPS)*

Hannah repeated step 4 for all the explants.

Hannah sterilised the scalpel and forceps at the start of the technique.

**(a)** Suggest how she did this.

_____

_____ [1]

**(b)** Suggest why it was important for Hannah to sterilise **the explants**.

_____

_____ [1]

All the cauliflowers produced were clones.

**(c)** What is a clone?

_____

_____ [1]

**(d)** Name the type of **reproduction** that the explants carried out in step 4.

_____ [1]

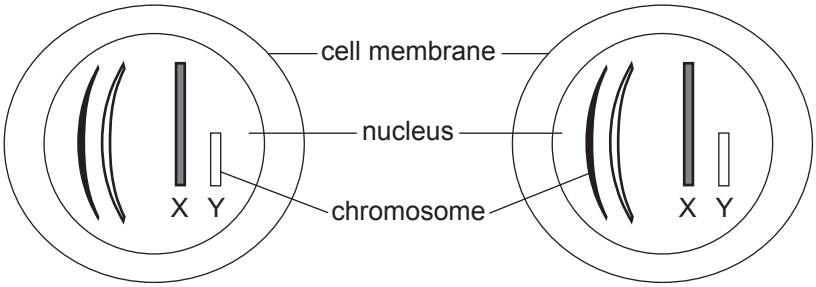
**(e)** Suggest **one disadvantage** of using tissue culture to produce plants.

_____

_____ [1]

**[Turn over**

**10** The diagram shows two cells before the start of the two different types of cell division. The diagram shows only four chromosomes in each cell.




**Cell A from the skin** **Cell B from the testes**



**(a)** Draw all the cells, with their chromosomes, that would be produced when cell A divides by **mitosis** in the skin.

[2]

During meiosis, independent assortment of chromosomes occurs.

**(b)** Draw all the cells, with their chromosomes, that would be produced when cell B divides by **meiosis** in the testes.

[4]

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| **Question Number** | **Marks** |
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