



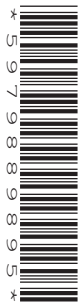
Oxford Cambridge and RSA

AS Level Biology B (Advancing Biology)

H022/02 Biology in depth

Tuesday 7 June 2016 – Afternoon

Time allowed: 1 hour 30 minutes


You must have:

- the Insert

You may use:

- a scientific calculator
- a ruler (cm/mm)



First name

Last name

Centre
numberCandidate
number

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION

- The total mark for this paper is **70**.
- The marks for each question are shown in brackets [].
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

Answer **all** the questions.

- 1 (a) The ultrastructure of plant cells has similarities and differences when compared to animal cells.

Fig. 1.1 shows an electron micrograph of a cell from a dicotyledonous plant.

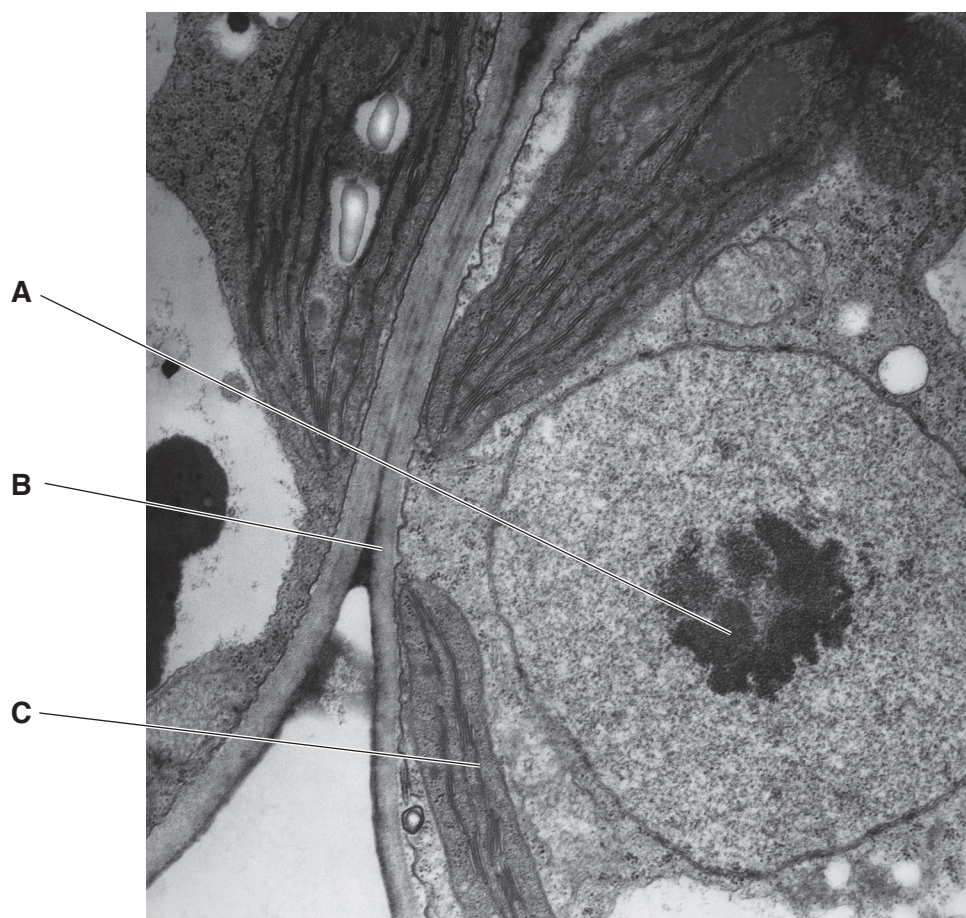


Fig. 1.1

State the **function** of the cell structures labelled **A** to **C** in Fig. 1.1.

A

B

C

[3]

3

- (b) (i) A light microscope was used to observe cells in the lower epidermis of a dicotyledonous leaf.

Fig. 1.2, **in the insert**, shows a stage micrometer and an eyepiece graticule.

The division shown on the stage micrometer measures $10\text{ }\mu\text{m}$.

Calculate the length of one eyepiece graticule unit.

Show your working.

Answer = μm [2]

- (ii) Fig. 1.3, **in the insert**, shows a stoma, guard cells and epidermal cells in the lower epidermis, as seen with a light microscope.

The magnification is the same as in Fig. 1.2.

Use the value you calculated in (b)(i) to calculate the length of the guard cell between points X and Y.

Answer = μm [2]

(c) A student made the following comment:

'If most water vapour is lost from leaves through open stomata, more transpiration must happen during daylight hours.'

The student used the apparatus shown in Fig. 1.4 to test their hypothesis over a 24 hour period.

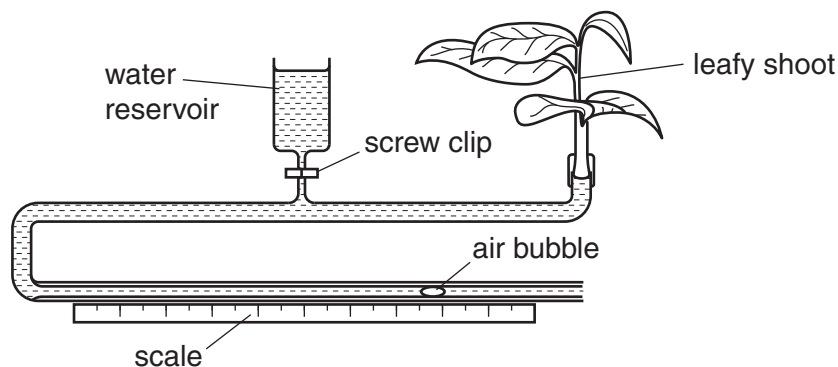


Fig. 1.4

(i) State the **dependent** variable in this investigation.

..... [1]

(ii) Temperature is a variable that must be controlled in the investigation to obtain valid data.

State **one** other variable and explain how it will be controlled.

Variable

How variable is controlled

.....

.....

.....

[1]

- (d)** *Euphorbia virosa* is a species of cactus that grows in the deserts of Namibia.

It uses the guard cells to close its stomata during the hottest part of the day.

Describe the sequence of events that occur inside guard cells resulting in the opening of stomata during daylight hours **and** suggest why the stomata of *E. virosa* are closed during the hottest part of the day.

[4]

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2 A group of students were investigating the protein content of a sports drink used by athletes.

- (a) Describe a method the students could use to confirm the presence of protein in the sports drink.

.....
.....
.....
..... [2]

- (b) The students added a protease enzyme to the sports drink to produce a solution containing amino acids.

Name the **type** of reaction catalysed by the protease enzyme.

..... [1]

8

(c) The students then separated the amino acids in the solution using chromatography.

Fig. 2 shows the chromatogram obtained by the students.

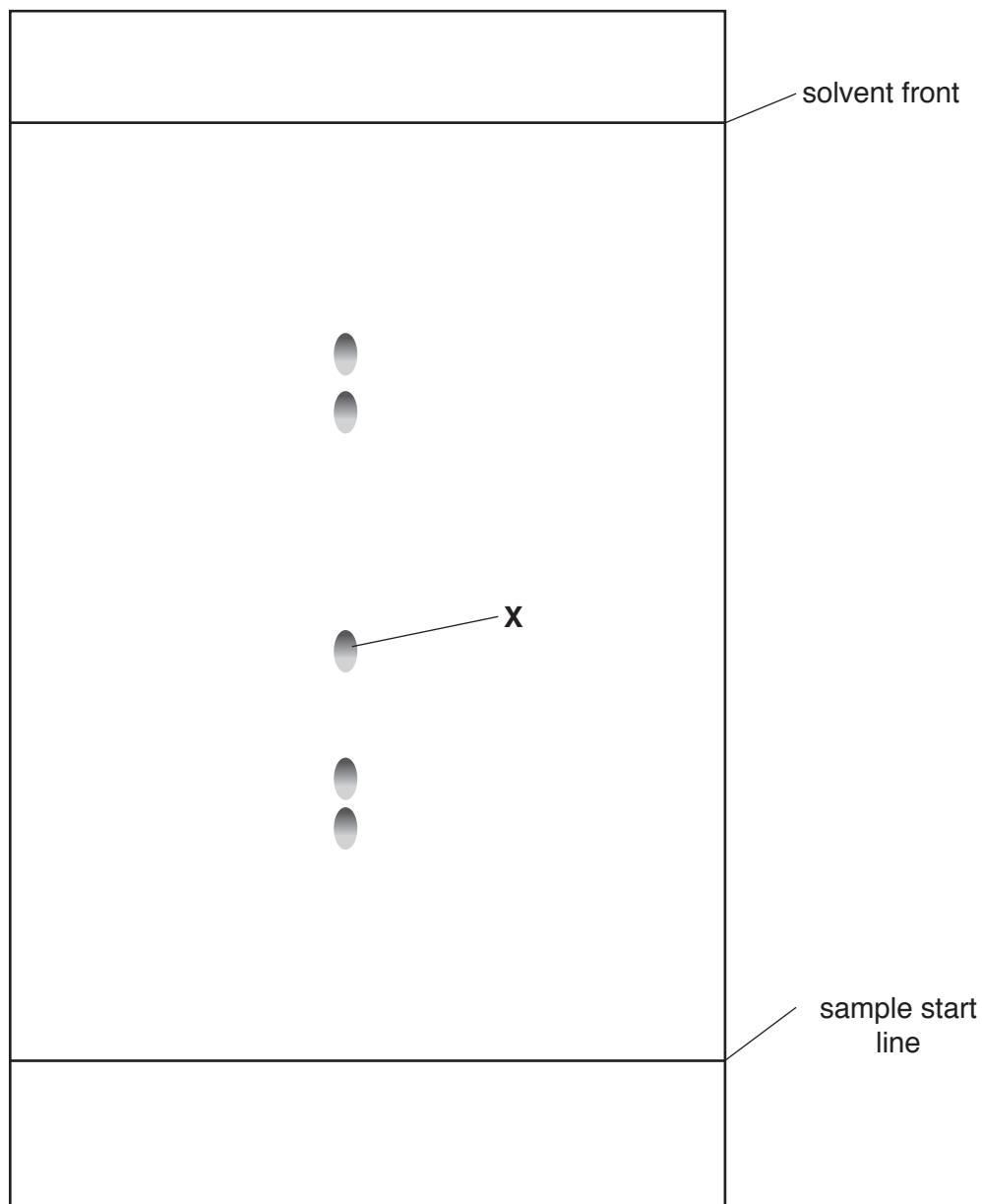


Fig. 2

Table 2 shows R_f values for six amino acids.

Amino acid	R _f value
asparagine	0.24
aspartic acid	0.29
isoleucine	0.73
phenylalanine	0.68
tryptophan	0.66
tyrosine	0.44

Table 2

- (i) Using Fig. 2, which of the amino acids named in Table 2 could be **X**?

Show working to support your answer.

X = [3]

- (ii) The students were concerned that they may not be able to distinguish between the amino acids phenylalanine and tryptophan on their chromatogram.

Using the information in Table 2, suggest **one** way the procedure could be modified to determine whether both phenylalanine and tryptophan were present.

Give a reason(s) for your suggestion.

.....

.....

.....

..... [2]

(d)* Proteases in the small intestine of an athlete will break down proteins in sports drinks.

The amino acids then enter the bloodstream and are transported to muscle cells.

In the muscle cells, amino acids are used to synthesise proteins such as myosin.

Explain how amino acids are transported to and taken up by muscle cells **and** then incorporated into proteins.

..... [6]

- 3 (a) The structure of the heart can be better understood through dissection.

Fig. 3.1, **in the insert**, shows a cross-sectional photograph of a dissected mammalian heart.

- (i) Name the parts of the heart labelled in **Fig. 3.1**.

M

N

[2]

- (ii) Fig. 3.2 shows a drawing of one side of the dissected heart.



Fig. 3.2

State **two** pieces of advice that could be given to improve the drawing in Fig. 3.2.

.....

 [2]

12

- (b) Atrial septal defect (ASD) is a condition caused when the septum of the heart has not formed correctly. This is also known as 'a hole in the heart' and is shown in Fig. 3.3.

In an adult with ASD, blood will leak from the left atrium into the right atrium.

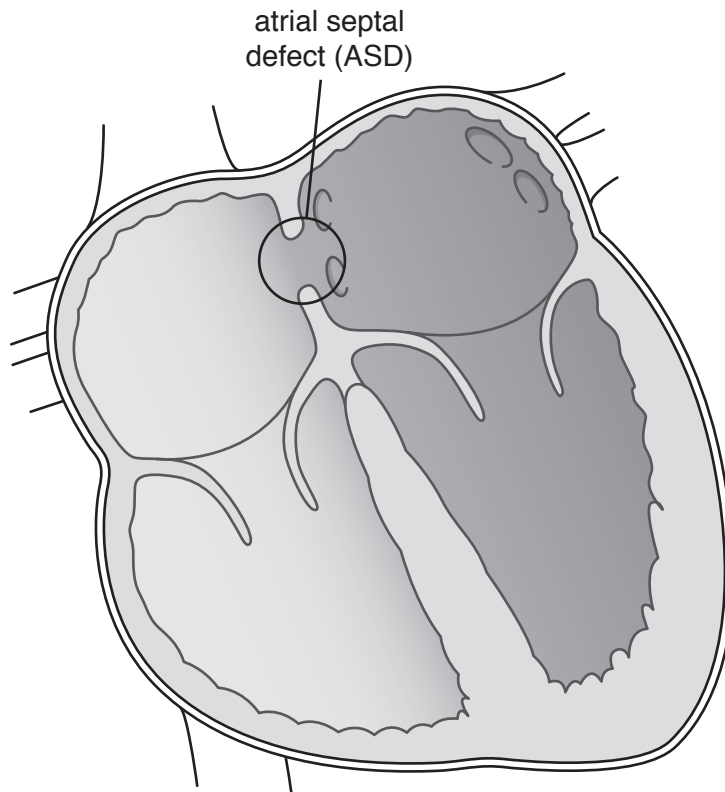


Fig. 3.3

- (i) Suggest why an adult with ASD would have an increased cardiac output from the right ventricle.

.....
 [1]

- (ii) Suggest why the muscles of an adult with ASD will fatigue more quickly.

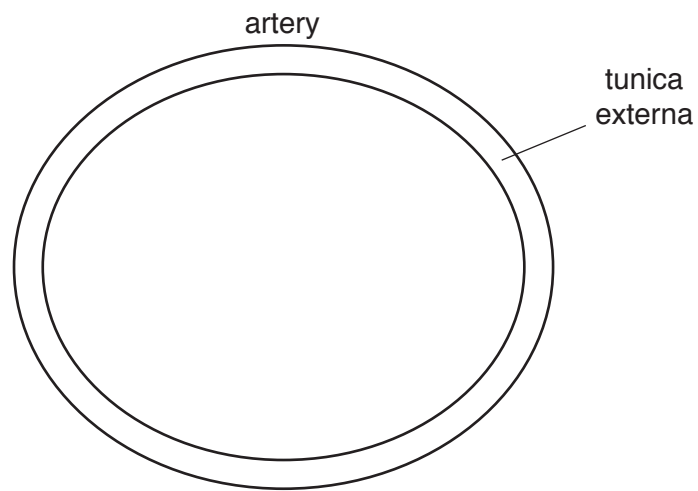
.....

 [2]

13

- (c) ASD can cause the pulmonary artery to become enlarged.

Complete the diagram in the space below to show the structure of a **healthy artery** as seen in transverse section.



[2]

- 4 An antibiotic sensitivity test can be used to assess the effectiveness of an antibiotic against bacteria.

Fig. 4.1 shows the results of an ampicillin antibiotic resistance test on samples of Gram-positive and Gram-negative bacteria.

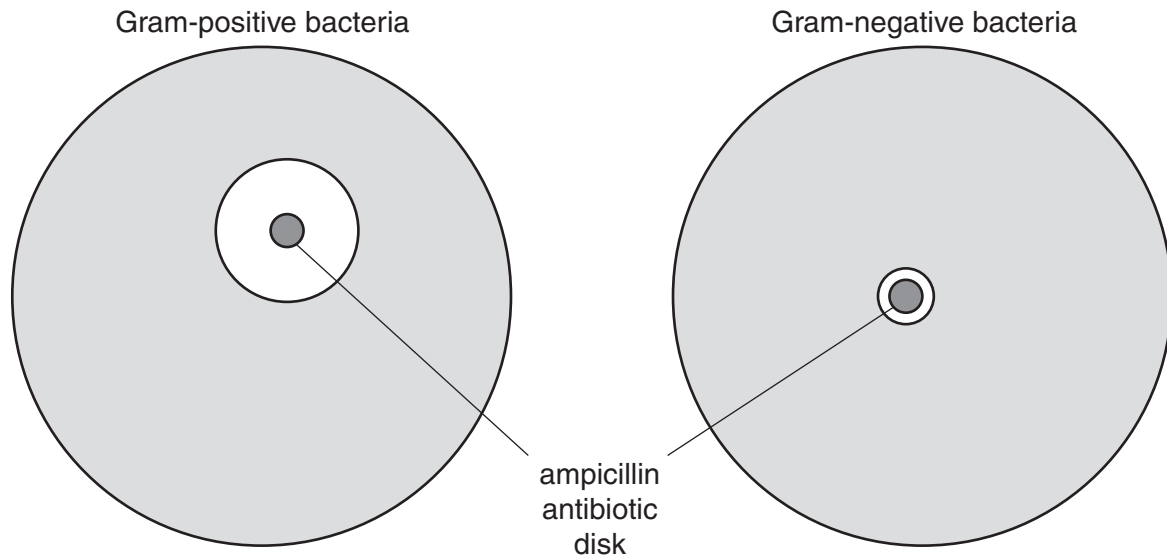


Fig. 4.1

- (a) Suggest why the zone of inhibition is smaller on the plate with the Gram-negative bacteria.

.....

.....

.....

.....

..... [2]

- (b) (i) *Streptococcus pneumoniae* is a Gram-positive bacterium commonly found in the throat of humans. These bacteria can spread from person to person and may cause pneumonia.

What name is given to a disease that is spread between different individuals?

..... [1]

- (ii) A sample of *S. pneumoniae* was prepared for viewing under a light microscope by Gram-staining a sample taken from a colony on an agar plate.

Suggest **three** steps that should have been taken to make sure that the procedure was carried out **aseptically**.

1

.....

2

.....

3

.....

[3]

- (c) *Mycobacterium tuberculosis* is a bacterium that can cause TB.

Screening for TB is done using a Mantoux test.

Explain why a person who has immunity to TB develops a red, raised lump following a Mantoux test.

.....

.....

.....

.....

.....

.....

..... [3]

- (d) Multidrug-resistant tuberculosis (MDR-TB) is a disease caused by a strain of *M. tuberculosis* that is resistant to the two most effective antibiotics, isoniazid and rifampicin.

Fig. 4.2 shows the number of cases of MDR-TB and the number of antibiotic prescriptions between 2000 and 2010.

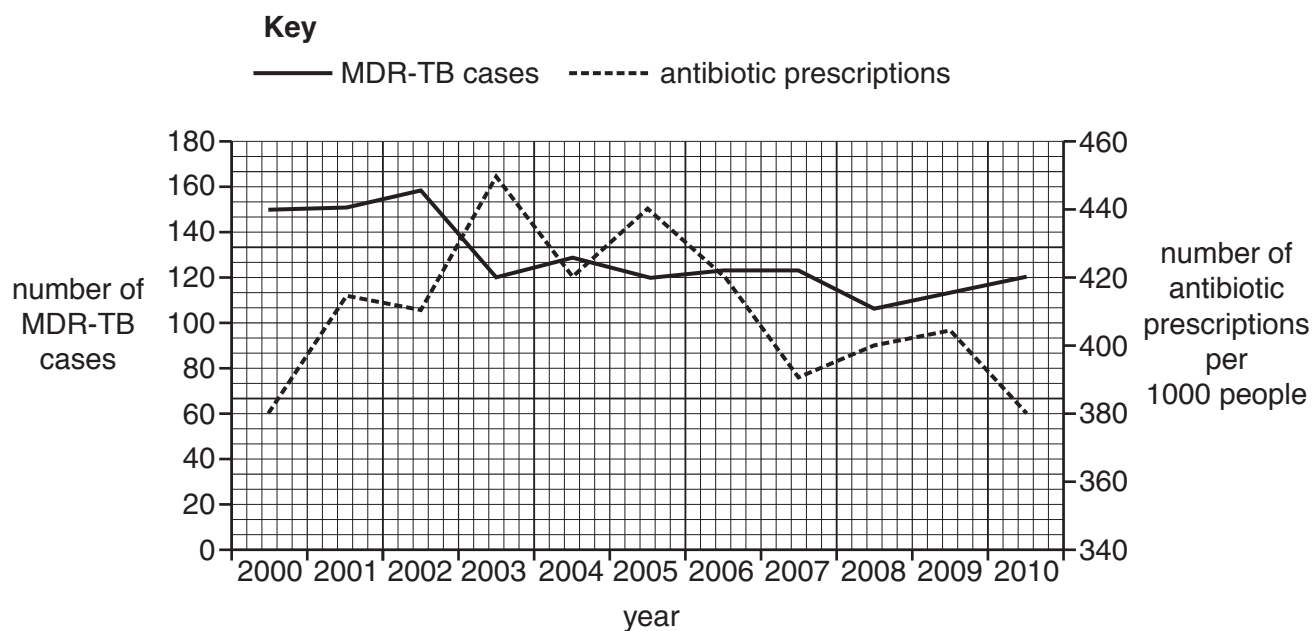


Fig. 4.2

- (i) Using Fig. 4.2, calculate the mean percentage decrease **per year** in the number of MDR-TB cases between 2000 and 2010.

Show your working.

Answer = % [2]

- (ii) Scientists have concluded that the increase in MDR-TB cases is due to the overuse of antibiotics.

Evaluate this conclusion using the data in Fig. 4.2.

.....

.....

.....

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.....

.....

..... [3]

- 5 (a) The cell cycle is a regulated process.

Fig. 5 shows three checkpoints in the cell cycle where mistakes may be corrected.

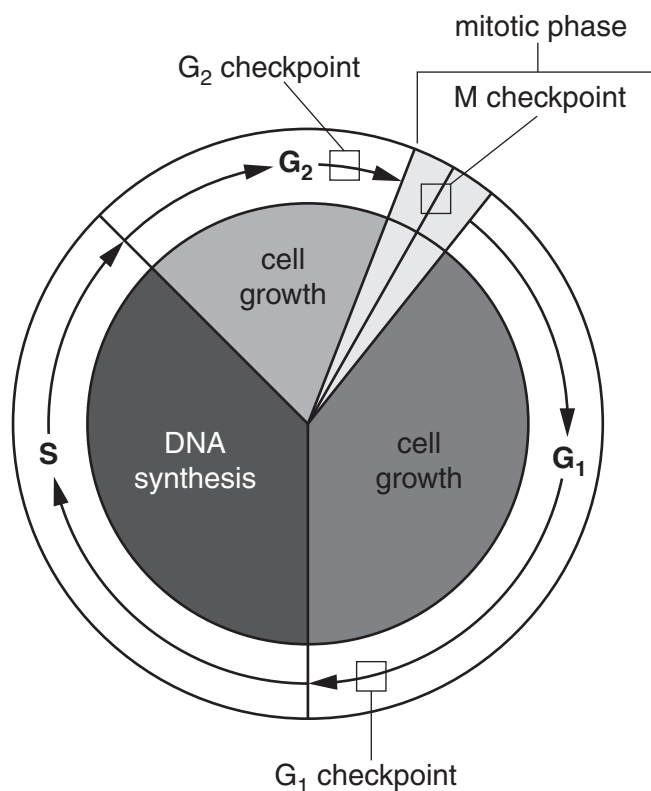


Fig. 5

Suggest how a faulty G₂ checkpoint may affect the cell cycle.

.....

.....

.....

.....

..... [2]

- [3]

- [6]

- 6 (a) A scientist wanted to observe the different stages of nuclear division.

Table 6 describes some events that occur during mitosis and meiosis in **plant cell** samples.

Complete Table 6 by placing a tick (✓) if the event described does occur in the type of nuclear division or a cross (✗) if the event does not occur.

The first row has been completed for you.

Event	Mitosis	Meiosis I	Meiosis II
Chromosomes condense in prophase	✓	✓	✗
Nuclear envelope breaks down in prophase			
Bivalent pairs line up in metaphase			
Centromere splits during anaphase			
Centrioles move to opposite poles of the cell during prophase			

Table 6

[4]

- (b) Explain how meiosis is significant in the life cycle of a plant.

.....

.....

.....

..... [2]

21

- (c) (i) DNA barcoding is a method of classifying different plant species based on their genes. Some of the genes used in DNA barcoding are found inside the nucleus of the cell.

Where else in a plant cell can genes be found for DNA barcoding?

..... [1]

- (ii) State **one** advantage and **one** disadvantage of using DNA barcoding to classify plant species.

Advantage

.....

Disadvantage

.....

[2]

END OF QUESTION PAPER

[illegible]

This image shows a blank sheet of white paper designed for writing. It features a series of evenly spaced horizontal blue lines across its entire width. A single vertical red line runs down the left side, creating a narrow margin. The paper is otherwise completely empty, with no text or markings.

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