

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
AS LEVEL**

**H022/02**

**BIOLOGY B (ADVANCING BIOLOGY)**

**Biology in depth**

**TUESDAY 7 JUNE 2016: Afternoon  
TIME ALLOWED: 1 hour 30 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>First name</b>		<b>Last name</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**YOU MUST HAVE:  
the Insert**

**YOU MAY USE:  
a scientific calculator  
a ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS**

**Use black ink. You may use an HB pencil for graphs and diagrams.**

**Complete the boxes on the first page 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.**

## **INFORMATION**

**The total mark for this paper is 70.**

**The marks for each question are shown in brackets [ ].**

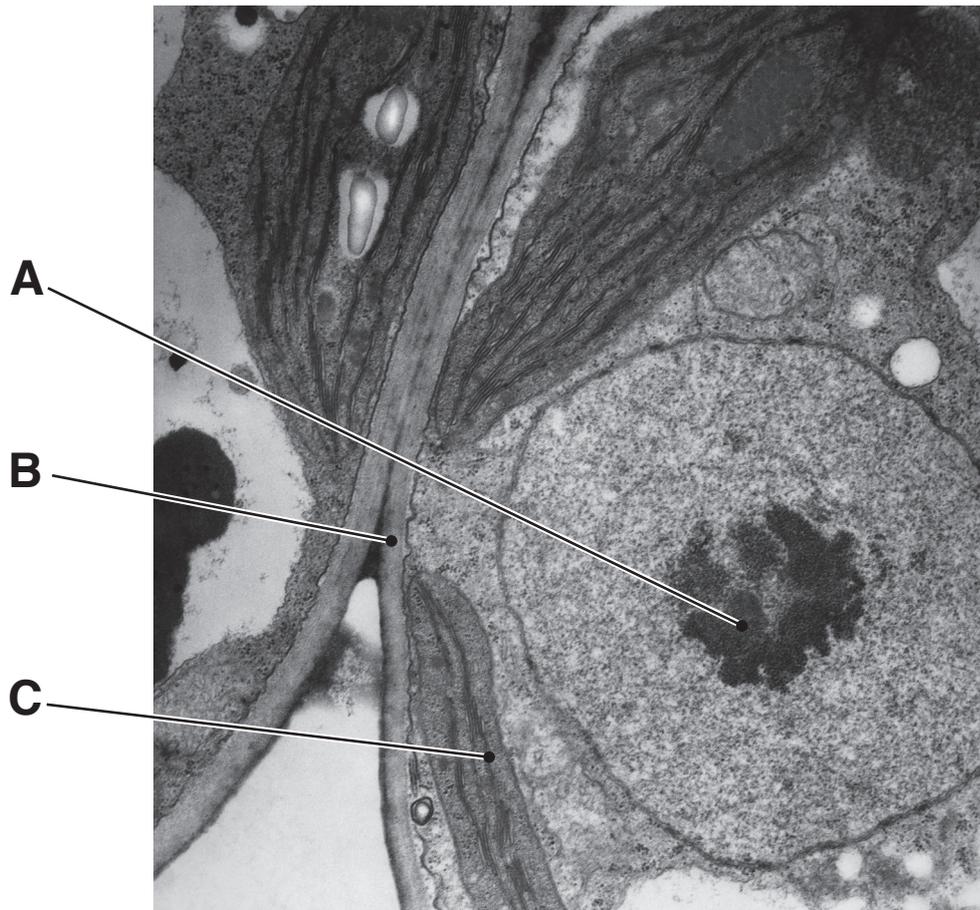
**Quality of extended responses will be assessed in questions marked with an asterisk (\*).**

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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]

- (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  $10\ \mu\text{m}$ .

Calculate the length of one eyepiece graticule unit.

Show your working.

Answer = \_\_\_\_\_  $\mu\text{m}$  [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.

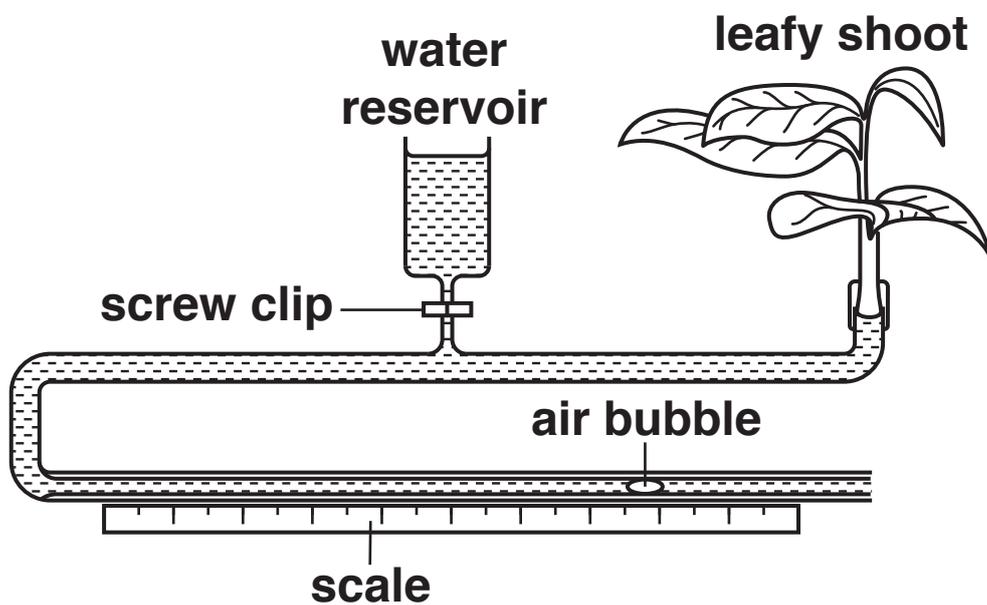
Answer = \_\_\_\_\_  $\mu\text{m}$  [2]

(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]



**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.**

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**[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.**

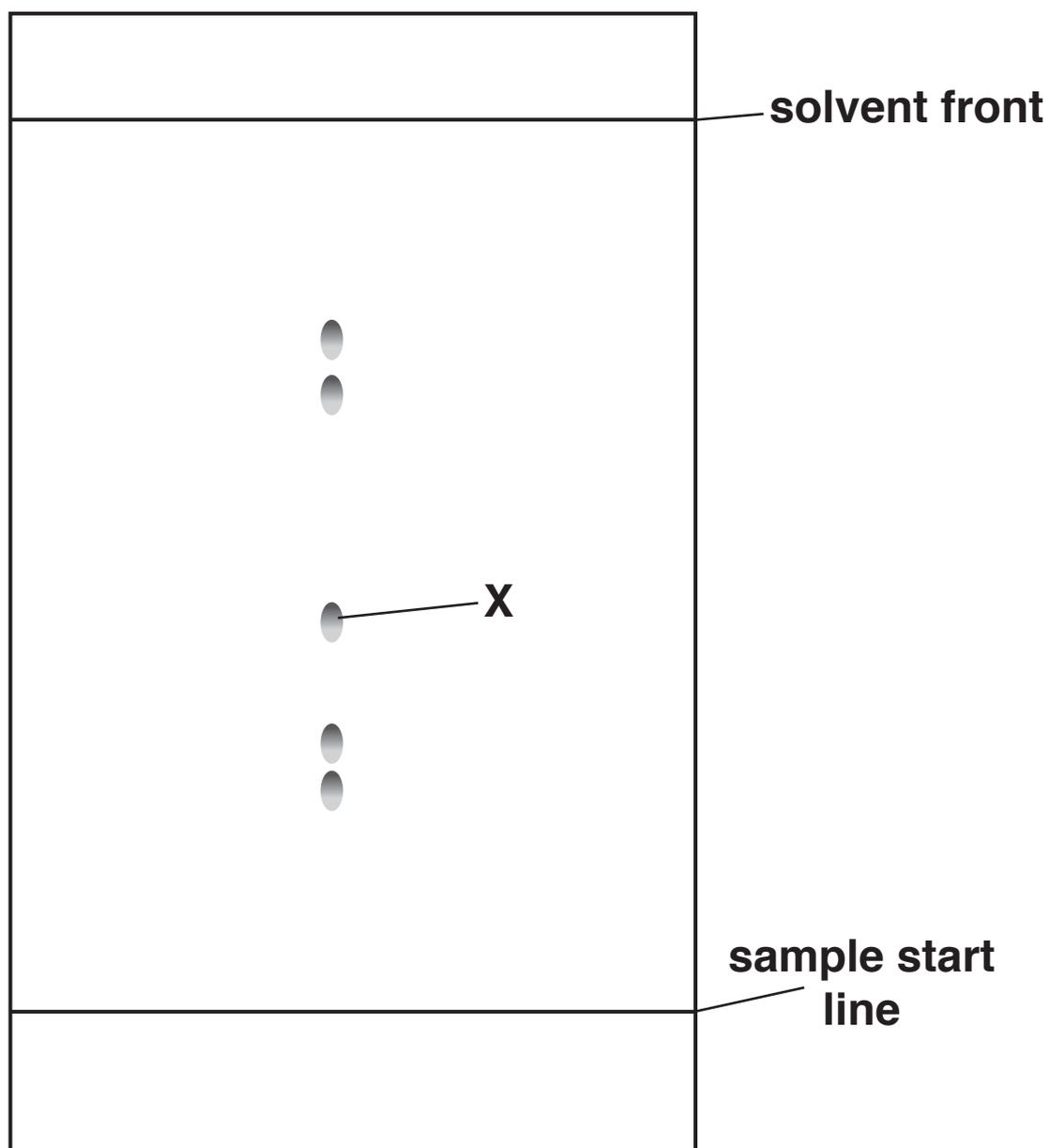
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**[1]**

(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 Rf values for six amino acids.**

**Table 2**

<b>Amino acid</b>	<b>Rf value</b>
<b>asparagine</b>	<b>0.24</b>
<b>aspartic acid</b>	<b>0.29</b>
<b>isoleucine</b>	<b>0.73</b>
<b>phenylalanine</b>	<b>0.68</b>
<b>tryptophan</b>	<b>0.66</b>
<b>tyrosine</b>	<b>0.44</b>

- (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.

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[2]





- 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.**

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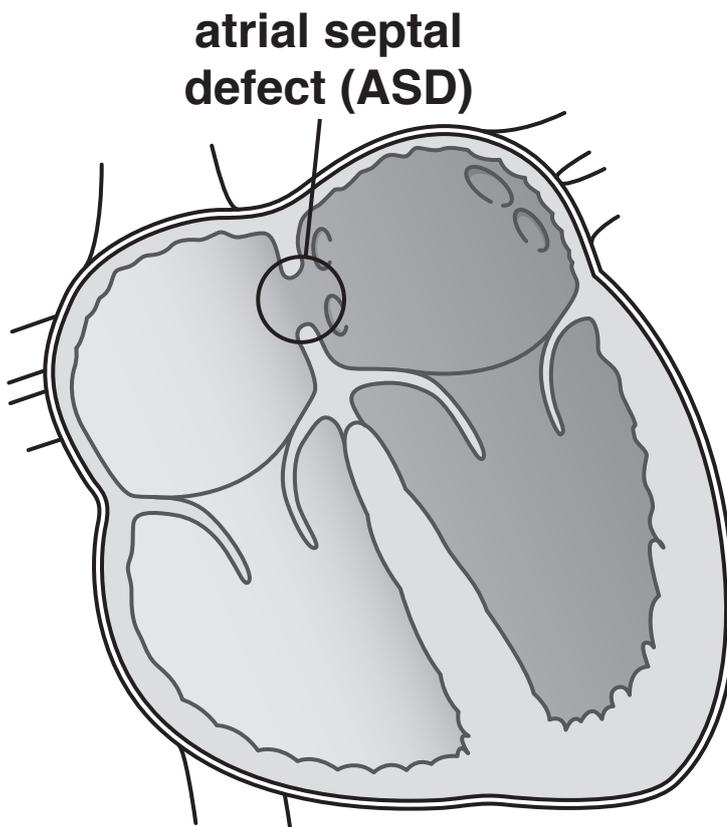
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**[2]**

- (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.**

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[1]

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

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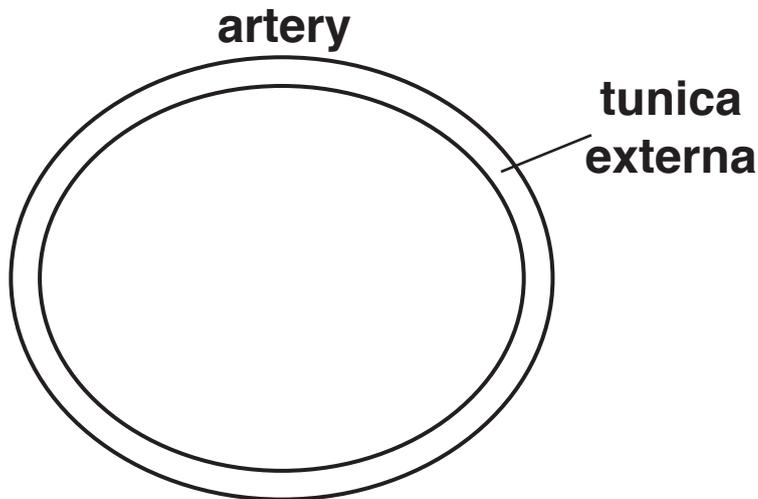
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[2]

(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.

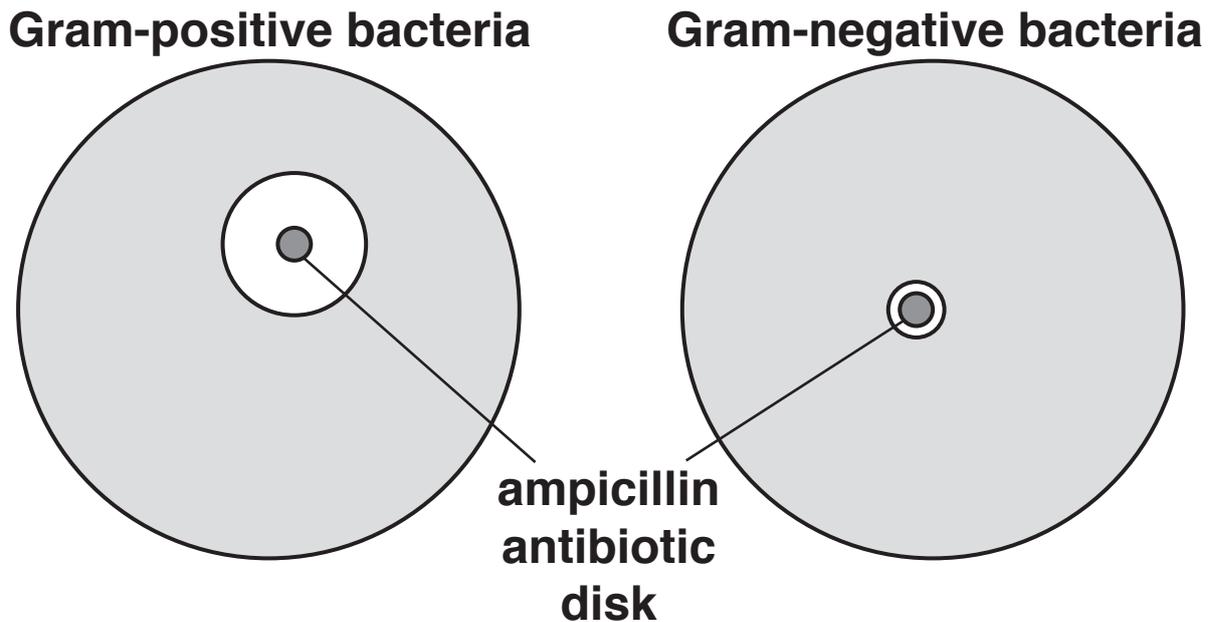


[2]

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.

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[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.

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[3]

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- (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.

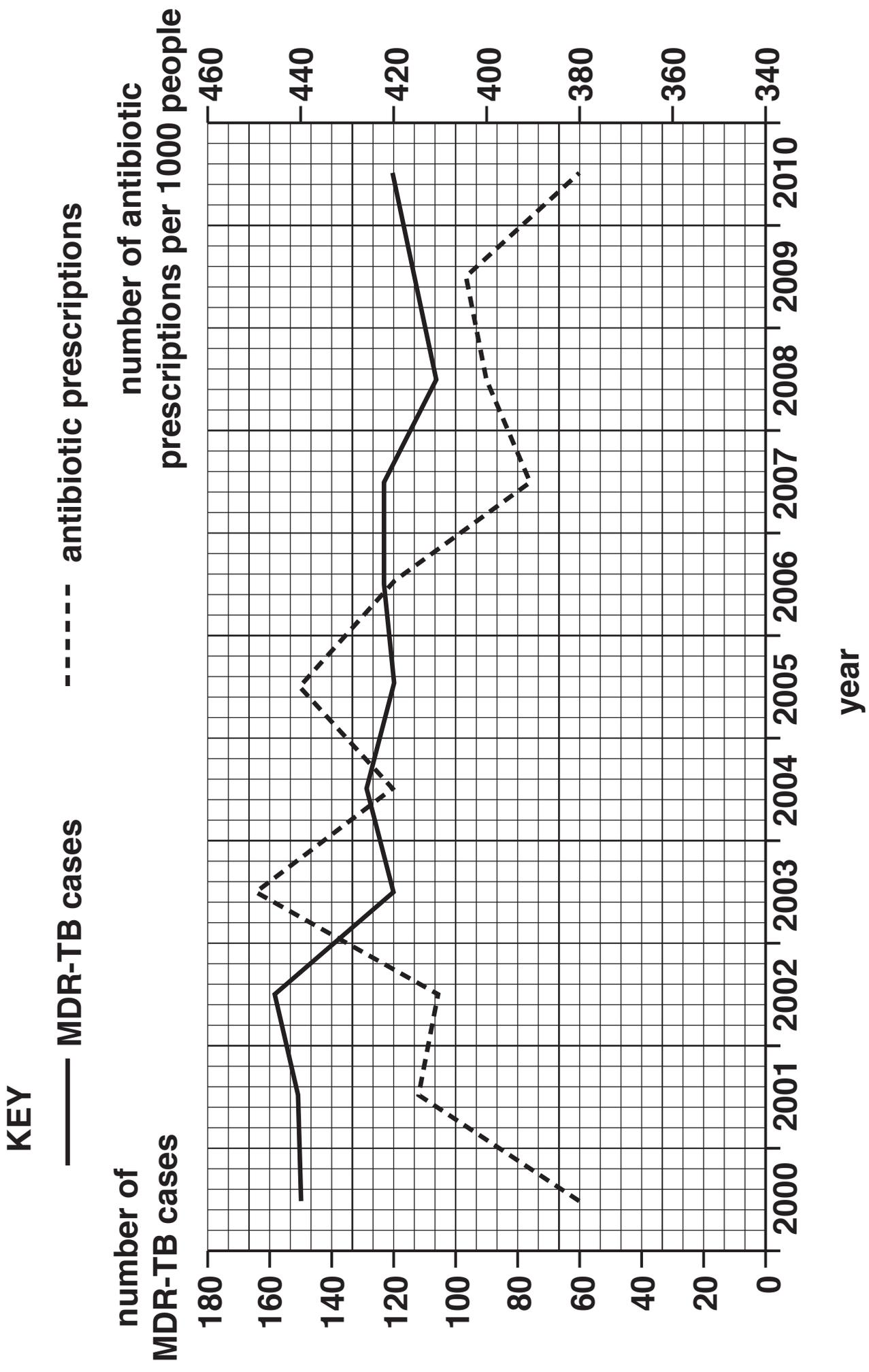
Fig. 4.2 opposite shows the number of cases of MDR-TB and the number of antibiotic prescriptions between 2000 and 2010.

- (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]

Fig. 4.2



**(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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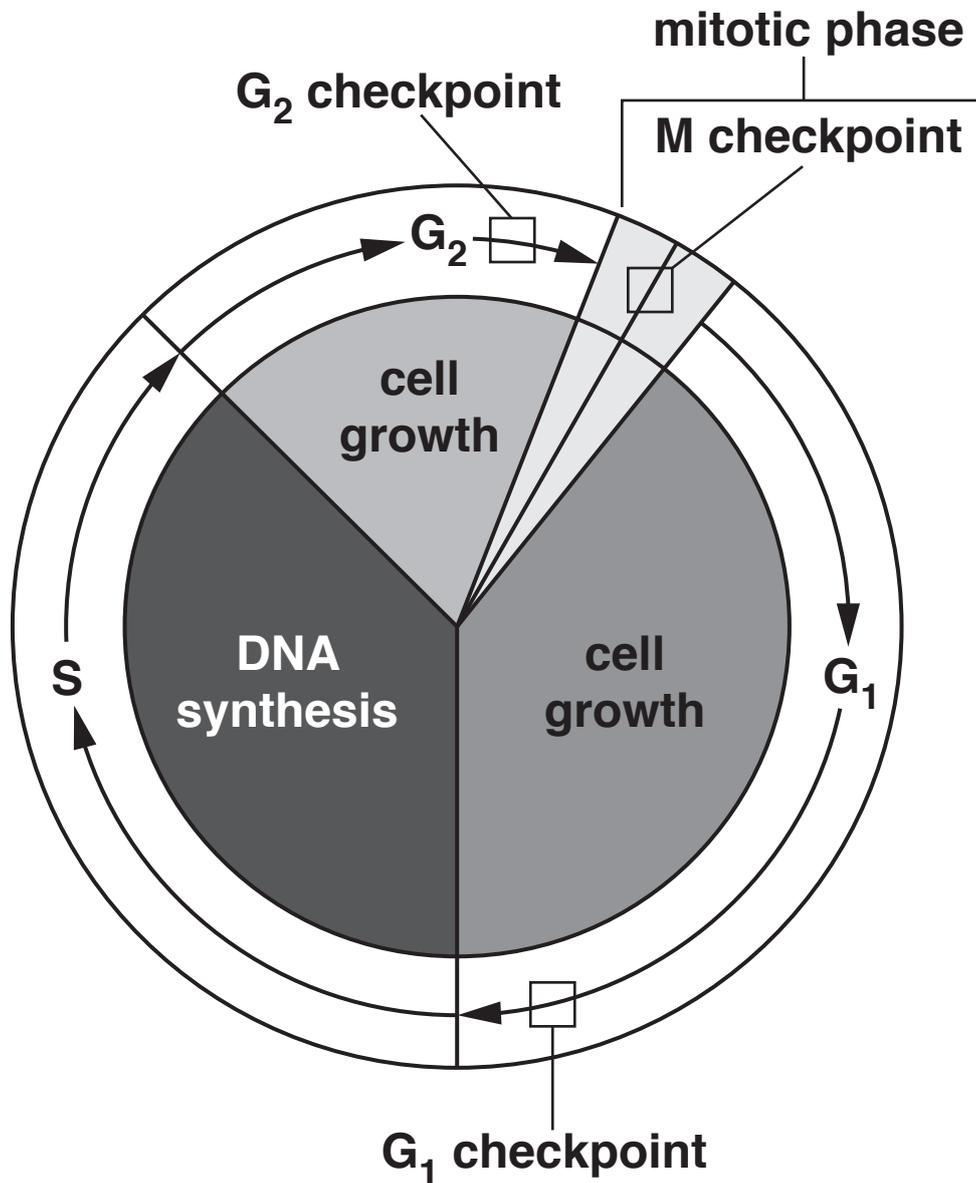
**[3]**

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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  $G_2$  checkpoint may affect the cell cycle.**

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**[2]**

**(b) It is thought that the *BRCA1* gene codes for a protein that is responsible for regulating the  $G_2$  checkpoint.**

**Breast cancer may be caused by the inheritance of a faulty *BRCA1* gene.**

**What techniques can be used by radiographers in the detection of cancers such as breast cancer?**

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**[3]**



- 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 (X) if the event does not occur.

The first row has been completed for you.

Table 6

EVENT	MITOSIS	MEIOSIS I	MEIOSIS II
Chromosomes condense in prophase	✓	✓	X
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			

[4]

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

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[2]

**(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?**

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[1]

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

**Advantage** \_\_\_\_\_

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**Disadvantage** \_\_\_\_\_

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[2]

**END OF QUESTION PAPER**










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