

## Friday 9 June 2023 – Afternoon

### GCSE (9–1) Biology B (Twenty First Century Science)

#### J257/02 Depth in Biology (Foundation Tier)

Time allowed: 1 hour 45 minutes



**You must have:**

- a ruler (cm/mm)

**You can use:**

- an HB pencil
- a scientific or graphical calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

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Last name

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### INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

### INFORMATION

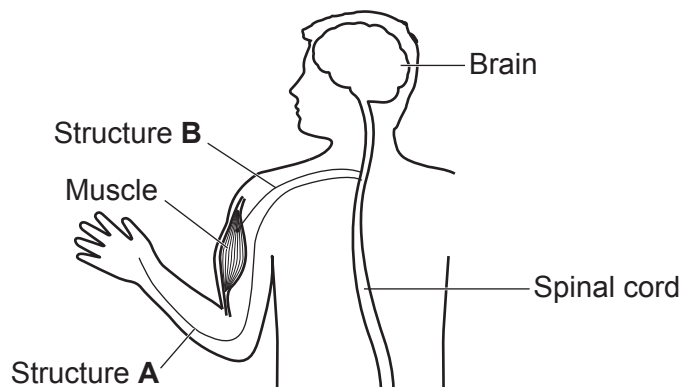
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document has **24** pages.

### ADVICE

- Read each question carefully before you start your answer.

1 Fig. 1.1 shows parts of the human nervous system.

Fig. 1.1



(a) Structure A allows us to sense the things we touch.

What is the name of structure A?

Put a **(ring)** around the correct option.

**CNS**                      **Effector**                      **Motor neuron**                      **Sensory neuron**                      **[1]**

(b) The muscle contracts to move the arm when it receives a nerve impulse from the brain.

What type of structure is the muscle?

Put a **(ring)** around the correct option.

**CNS**                      **Effector**                      **Motor neuron**                      **Sensory neuron**                      **[1]**

(c) Structure B carries nerve impulses from the brain to the muscle.

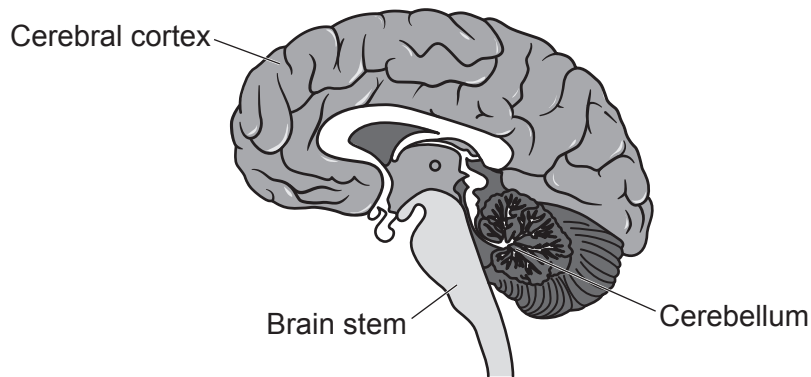
What is the name of structure B?

Put a **(ring)** around the correct option.

**Motor neuron**                      **Reflex arc**                      **Sensory neuron**                      **Synapse**                      **[1]**

(d) Fig. 1.2 shows a diagram of the human brain.

Fig. 1.2



Draw lines to connect each **part** of the brain with the **function** it controls.

| Part            | Function                      |
|-----------------|-------------------------------|
| Brain stem      | Conscious movement            |
| Cerebellum      | Heart rate and breathing rate |
| Cerebral cortex | Intelligence and memory       |

[2]

2 The things we eat and drink are processed by our body.

(a) Complete the sentences to describe what happens in our body when we drink water.

Use words from the list.

|                         |                    |                  |                  |              |             |
|-------------------------|--------------------|------------------|------------------|--------------|-------------|
| <b>active transport</b> | <b>circulatory</b> | <b>digestive</b> | <b>excretory</b> | <b>heart</b> |             |
| <b>kidney</b>           | <b>osmosis</b>     | <b>oxygen</b>    | <b>pancreas</b>  | <b>water</b> | <b>urea</b> |

Water is absorbed into the blood from the ..... system.

Some of the water moves into and out of cells by .....

The blood is filtered by an organ called the .....

This organ filters water and ..... out of the blood.

This organ then reabsorbs as much ..... as the body needs to stay healthy.

[5]

(b) A student says, "I think cutting all the sugar and fatty acids out of my diet will be good for me."

(i) The student is **wrong**.

Explain how the student's body cells use sugar **and** fatty acids.

.....  
.....  
.....  
.....  
.....  
.....  
..... [3]

(ii) The student's body cells also need amino acids.

Explain what the student's body cells make using amino acids **and** how their genome is involved.

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

(iii) Where is the genome stored in the student's cells?

..... [1]

(iv) The genome is made of DNA.

Complete the sentence to describe the structure of DNA.

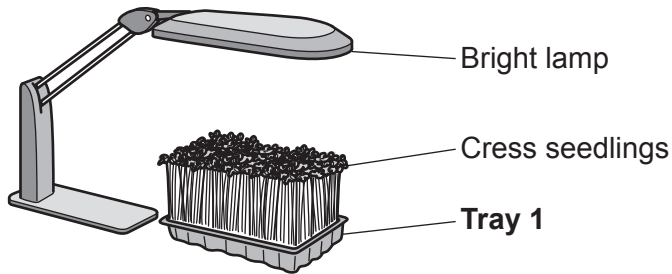
Put a ring around each correct option.

DNA is a polymer made from **two** / **four** different nucleotides in a **single** / **double** helix. [1]

- 3 Zayn investigates if cress plants grow towards the light.

Zayn puts 200 cress seeds in a tray of damp soil and places the tray directly underneath a bright lamp. The tray is labelled **Tray 1**.

The diagram shows the cress in **Tray 1** after 7 days under the lamp.



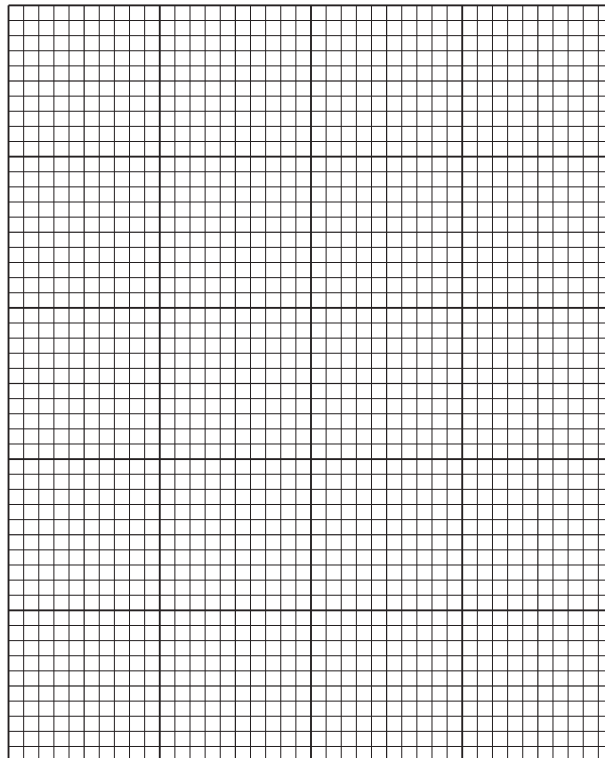
- (a) Zayn calculates the percentage of cress seedlings in **Tray 1** that grew straight up and that grew curved towards the side.

The percentages are shown in **Table 3.1**.

**Table 3.1**

|                                     | Percentage of seedlings in Tray 1 (%) |
|-------------------------------------|---------------------------------------|
| <b>Grew straight up</b>             | 92                                    |
| <b>Grew curved towards the side</b> | 8                                     |

Plot the percentages from **Table 3.1** as a bar chart.





(d) **Tray 1** and **Tray 2** were both left in the light for 7 days.

(i) Describe **two** things that could have caused the amount of light received by the seedlings in **Tray 2** to change over the 7 days.

1 .....

.....

2 .....

.....

[2]

(ii) Describe **one** way Zayn could have controlled the amount of light received by the seedlings in **Tray 2**.

.....

.....

.....

.....

[2]

(e) Which process caused the seedlings in **Tray 2** to curve towards the window?

Tick (✓) **one** box.

|                |                          |
|----------------|--------------------------|
| Gravitropism   | <input type="checkbox"/> |
| Photosynthesis | <input type="checkbox"/> |
| Phototropism   | <input type="checkbox"/> |

[1]

(f) State the name of the plant **hormone** that caused the seedlings in **Tray 2** to curve towards the window.

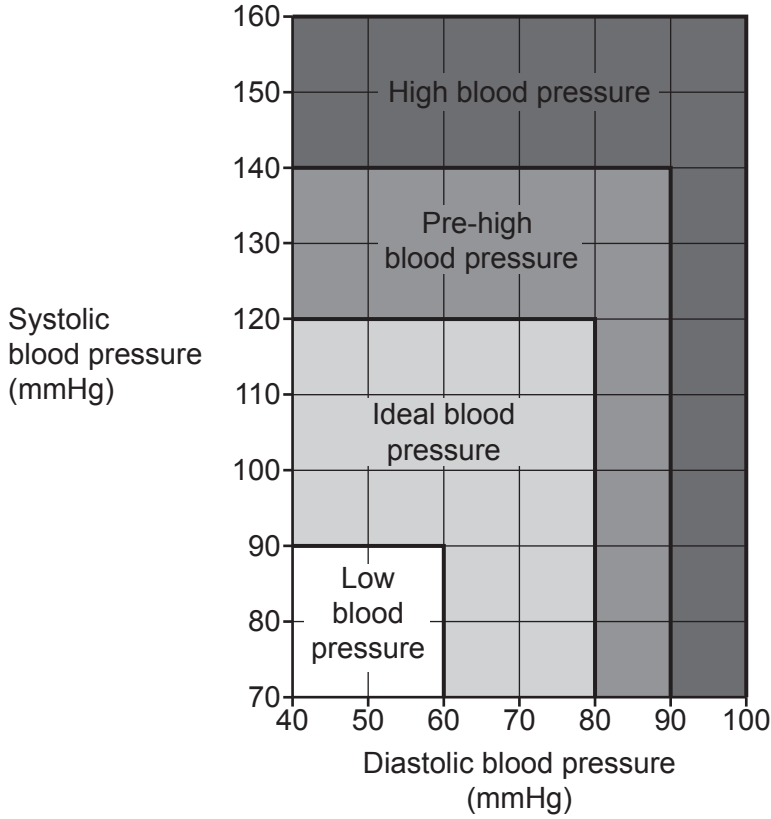
..... [1]



4 Leo is a 52-year-old man. He is having a health check-up.

- (a) Leo has his blood pressure measured.  
The doctor uses **Fig. 4.1** to decide which blood pressure category Leo is in.

**Fig. 4.1**



Leo's diastolic blood pressure is 76 mmHg.  
Leo's systolic blood pressure is 141 mmHg.

- (i) What can you conclude about Leo's blood pressure from **Fig. 4.1**?

.....

.....

.....

..... [2]

- (ii) Leo's diastolic pressure remains at 76 mmHg.

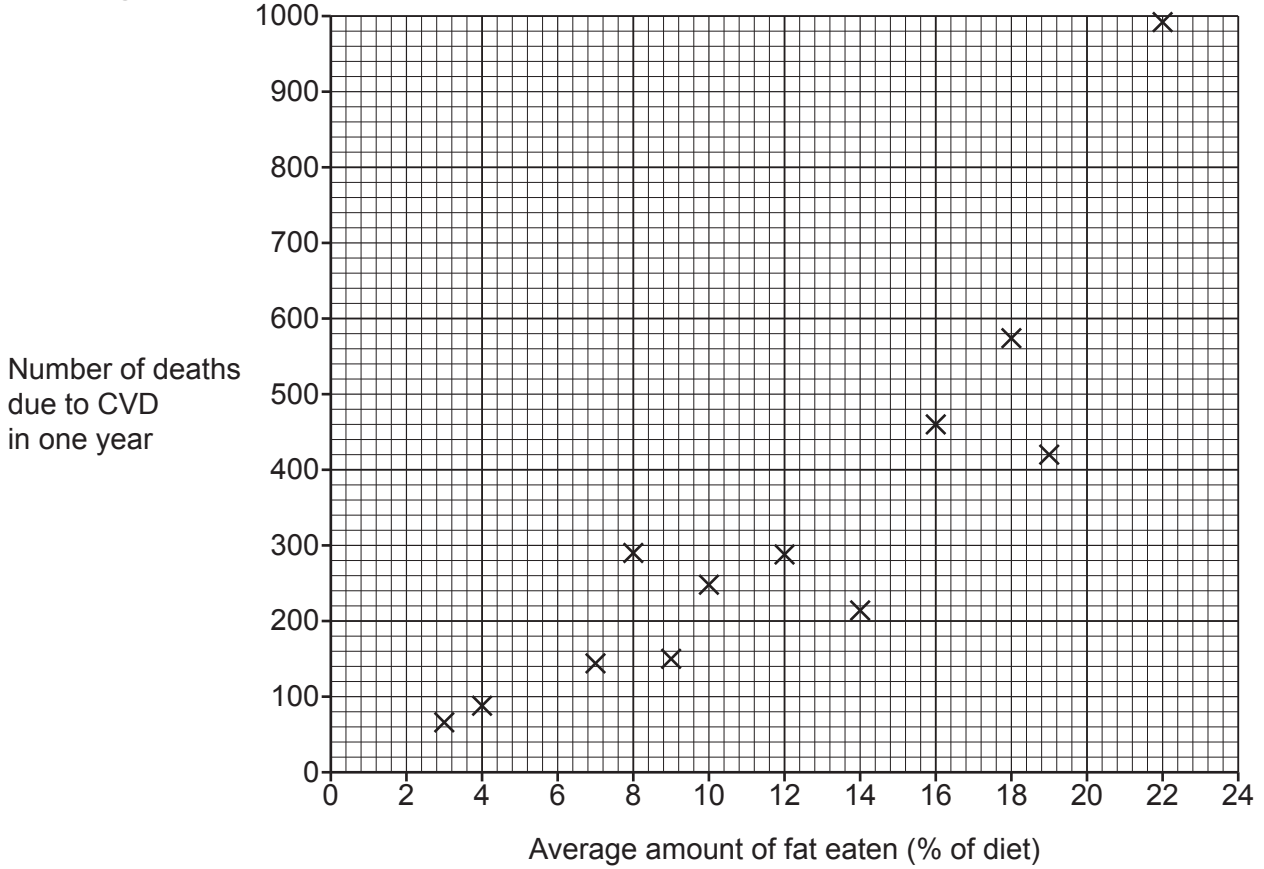
What range of systolic blood pressure would be ideal blood pressure for Leo?

Ideal systolic blood pressure range = ..... to ..... mmHg [2]

- (b) High blood pressure is one factor that increases the risk of cardiovascular disease (CVD). Other factors also increase this risk.

Fig. 4.2 shows data on the average amount of fat eaten and the number of deaths due to CVD in one year in a sample of 100 000 people from the UK.

Fig. 4.2



- (i) Describe the trend in the data, using Fig. 4.2.

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

- (ii) Explain how the amount of fat eaten could have an effect on the number of deaths due to CVD.

Use ideas about changes in the body caused by eating fat.

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..... [3]

(iii) Fig. 4.2 shows data from a sample of 100 000 people.

What groups of people would you expect to be included in the sample to make it **representative** of the whole population of the UK?

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.....  
.....  
.....  
..... [3]

(iv) In this sample of 100 000 people, 3934 people died of CVD in one year.

Calculate how many people you would expect to die in the UK population from CVD in one year.

The UK population is 60 000 000.

Number of people = ..... [2]

(c) The doctor makes some notes about Leo.

- Blood pressure: 141/76 mmHg
- Amount of fat eaten: 22% of diet
- Occupation: Office worker (drives to work)

(i) Suggest **two** lifestyle changes Leo could make, other than taking medicine, to reduce his risk of CVD.

1 .....  
.....  
2 .....  
..... [2]

(ii) Leo is worried about taking medicine to treat his CVD.

Complete the table by describing how the medicine was tested.

|                             | Medicine tested on       | Medicine tested for      |
|-----------------------------|--------------------------|--------------------------|
| <b>Pre-clinical testing</b> | .....<br>.....           | Safety and effectiveness |
| <b>Clinical testing</b>     | Healthy human volunteers | .....<br>.....           |

[2]

(iii) Identify **one** risk for Leo if he takes the medicine.

..... [1]

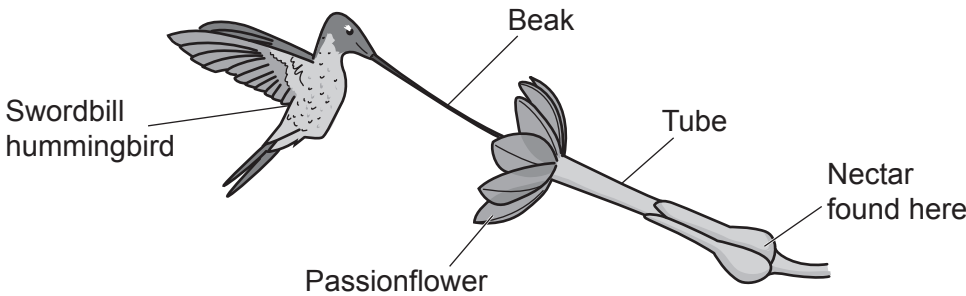
(iv) Without medicine and lifestyle changes, Leo may need heart surgery.

Evaluate the use of lifestyle changes to treat Leo compared with the use of surgery.

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

5 Species evolve over time. This evolution can be explained using ideas about the process of natural selection.

(a) Read the article.



One species of hummingbird called a swordbill is the only bird that has a beak longer than its body. It is the most common species of hummingbird in one region of South America.

This region is the only place where a species of plant called a passionflower grows. The passionflower has a long tube with nectar at the bottom. Swordbills feed on the nectar.

(i)\* Explain why the swordbill has become the most common species of hummingbird in the region where this passionflower grows.

Use ideas about natural selection in your answer.

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..... [6]

- (ii) Humans are chopping down trees in which the swordbill hummingbird lives. This could cause a large decrease in the size of the swordbill population.

Explain how **two other** factors could cause a decrease in the size of the swordbill population.

1 .....

2 .....

[2]

- (iii) When swordbill hummingbirds feed on the nectar, they transfer pollen between passionflowers. The pollen contains the male gametes of the passionflowers.

Explain why chopping down the trees in which the hummingbirds live could put the passionflowers in danger of extinction.

.....  
.....  
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.....  
.....  
.....

[3]

- (b) Darwin and Wallace suggested that natural selection could be an explanation for the evolution of species.

Describe **two** pieces of evidence that helped them to develop their explanation.

1 .....

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[4]

- (c) Which **two** statements explain the **impacts** of Darwin and Wallace’s explanation for the evolution of species?

Tick (✓) **two** boxes.

Everybody now believes that it is true.

It can help to explain modern examples of evolution.

Most scientists accept that it is the best explanation for evolution.

The explanation has been mostly ignored by the scientific community.

[1]

- (d) A type of bacteria uses an enzyme to digest nylon.  
Nylon was invented in 1935.

Scientists think this new enzyme only appeared in bacteria after 1935.

Describe the changes in the bacteria that allowed them to make the new enzyme.

.....

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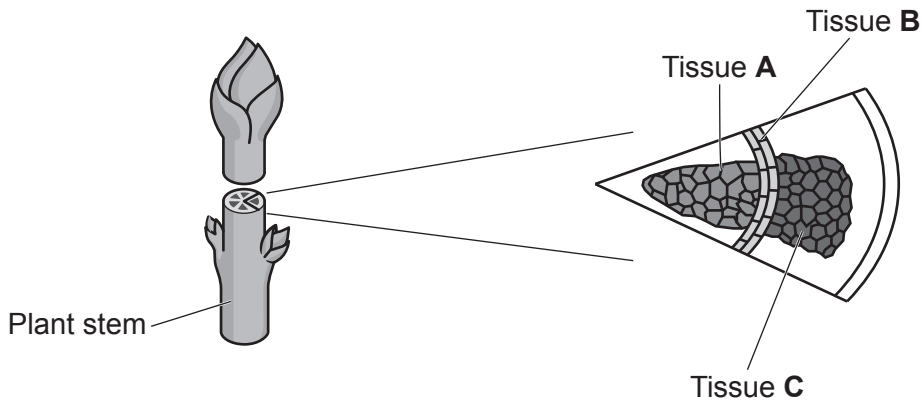
.....

[3]

6 A scientist cuts a thin slice from a plant stem, as shown in **Fig. 6.1**.

The slice of stem contains three different tissues.

**Fig. 6.1**



(a) Draw lines to connect the **description** of each tissue with its correct **name**.

One has been done for you.

| Description  | Name      |
|--|-----------|
| Tissue <b>A</b><br>transports water from<br>the plant's roots  | Capillary |
| Tissue <b>B</b><br>is made of<br>unspecialized cells           | Meristem  |
| Tissue <b>C</b><br>transports sugar from<br>the plant's leaves | Phloem    |
|  | Xylem     |

A line is drawn from the 'Meristem' box to the 'Tissue B' description box.

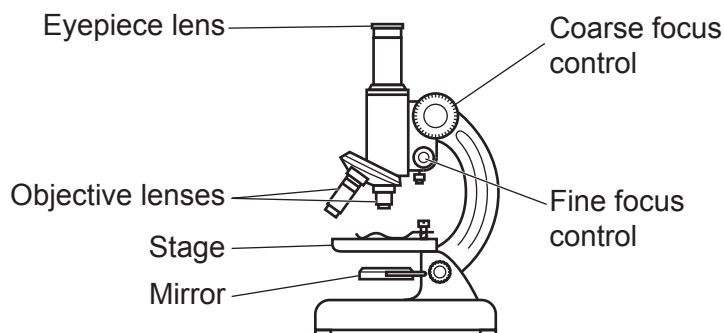
[1]



(b) The scientist places the slice of stem on a microscope slide and adds a cover slip.

The scientist uses the light microscope in **Fig. 6.2** to look at the slice of stem on the slide.

**Fig. 6.2**



(i) Statements **A** to **E** describe steps the scientist uses to look at the slide under the microscope.

They are **not** in the correct order.

- A** Place the slide on the stage.
- B** Look into the eyepiece lens.
- C** Use the coarse focus control to move the objective lens down towards the stage.
- D** Use the fine focus control to move the objective lens until the image is as clear as possible.
- E** Use the coarse focus control to move the objective lens upwards until the image is clear.

Write the letters in the boxes to describe the correct order of the steps.

One has been done for you.

|  |          |  |  |  |
|--|----------|--|--|--|
|  | <b>A</b> |  |  |  |
|--|----------|--|--|--|

[3]

(ii) Suggest **two** ways the scientist can work safely when using the microscope.

1 .....

.....

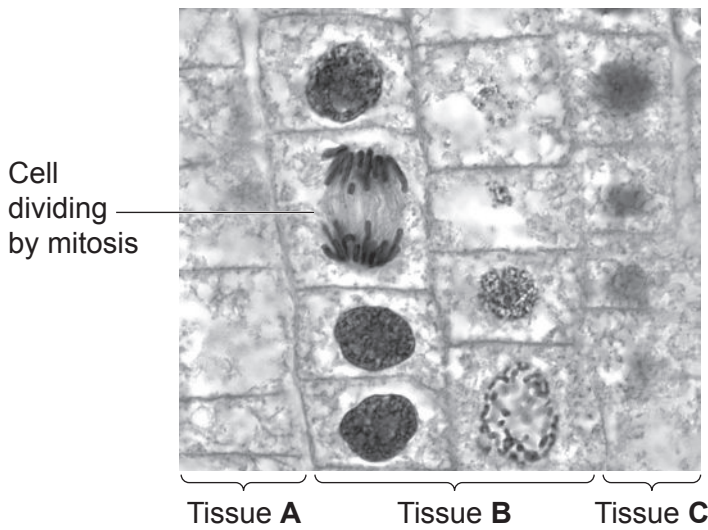
2 .....

.....

[2]

(c) Fig. 6.3 shows part of the slice of stem. One of the cells is dividing by mitosis.

Fig. 6.3



(i) The chromosomes in the labelled dividing cell are clearly visible and appear dark.

Describe what the scientist added to the slide to make the chromosomes clearly visible.

..... [1]

(ii) To get the image in Fig. 6.3 the scientist used an eyepiece lens with a magnification of  $\times 10$ , and an objective lens with a magnification of  $\times 40$ .

Describe how to calculate the total magnification.

.....  
 ..... [1]

(d) One of the dividing cells in Fig. 6.3 has a width of  $10\ \mu\text{m}$ .

(i) What is  $10\ \mu\text{m}$  to the nearest order of magnitude?

Put a ring around the correct option.

$10^0\ \mu\text{m}$                        $10^1\ \mu\text{m}$                        $10^2\ \mu\text{m}$                        $10^3\ \mu\text{m}$                       [1]

(ii) In the dividing cell, a single chromosome has a width of  $0.01\ \mu\text{m}$ .

How many orders of magnitude larger is the cell than the single chromosome?

Put a ring around the correct option.

**3**                                      **30**                                      **100**                                      **1000**                                      [1]

7 Plant cells in the leaf of a tree contain chloroplasts and mitochondria.

(a) Complete the sentences about the processes that take place in chloroplasts and mitochondria.

Use words from the list.

|                             |                |                       |                      |
|-----------------------------|----------------|-----------------------|----------------------|
| <b>cellular respiration</b> | <b>meiosis</b> | <b>photosynthesis</b> | <b>transpiration</b> |
|-----------------------------|----------------|-----------------------|----------------------|

In the chloroplasts, glucose is made by .....

The glucose is used in the mitochondria in .....

[1]

(b) The process of cellular respiration takes place continuously in plant cells.

Explain why it has to take place continuously.

.....  
..... [1]



**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

This block contains a large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.





A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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