Oxford Cambridge and RSA

Tuesday 13 May 2025 – Afternoon

GCSE (9–1) Biology A (Gateway Science)

J247/01 (Foundation Tier)

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)

You can use:
- a scientific or graphical calculator
- an HB pencil

F

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

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

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 **32** pages.

ADVICE
- Read each question carefully before you start your answer.

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Section A

You should spend a **maximum** of **30 minutes** on this section.

Write your answer to each question in the box provided.

1 Which of these is a plant hormone?

A Auxin

B FSH

C Insulin

D Testosterone

Your answer ☐ **[1]**

2 Which system in the human body releases hormones from glands?

A Circulatory system

B Endocrine system

C Nervous system

D Respiratory system

Your answer ☐ **[1]**

3 Which molecule supplies cells with their energy requirements?

A Amino acid

B ATP

C Auxin

D DNA

Your answer ☐ **[1]**

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4 Which piece of equipment is used to measure the rate of water uptake from a leafy shoot?

A Microscope

B Potometer

C Thermometer

D Water bath

Your answer ☐ **[1]**

5 A student tests a sample of milk to see if it contains sugar.

Which reagent would the student use and what colour would be observed for a **positive** result?

	Reagent	**Colour observed for a positive result**
A	Benedict's solution	purple
B	Benedict's solution	red
C	Biuret solution	purple
D	Biuret solution	red

Your answer ☐ **[1]**

6 Which two substances are products of **anaerobic** respiration in plants?

A Ethanol and carbon dioxide

B Glucose and carbon dioxide

C Lactic acid and carbon dioxide

D Water and carbon dioxide

Your answer ☐ **[1]**

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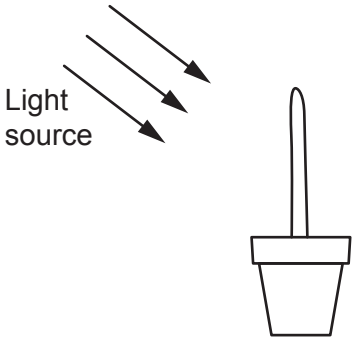
7 The diagram shows a plant shoot and a source of light.



Which effect will this light source have on the plant shoot?

A The plant shoot will continue to grow upwards.

B The plant shoot will grow away from the light.

C The plant shoot will grow towards the light.

D The plant shoot will stop growing.

Your answer ☐ **[1]**

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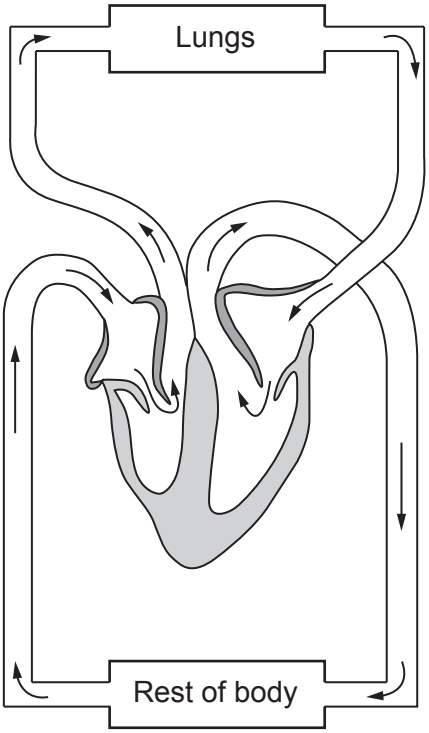
8 The diagram shows the human circulatory system.



What describes the route the blood will take when it leaves the lungs and passes to the rest of the body?

A Pulmonary artery → left atrium → left ventricle → aorta (artery)

B Pulmonary artery → right atrium → right ventricle→ vena cava (vein)

C Pulmonary vein → left atrium → left ventricle → aorta (artery)

D Pulmonary vein → right atrium → right ventricle → vena cava (vein)

Your answer ☐ **[1]**

9 The enzyme protease is added to a sample of protein.

What will **increase** in concentration?

A Amino acids

B Fatty acids

C Glucose

D Glycerol

Your answer ☐ **[1]**

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10 What describes the pathway of a **reflex arc**?

A Effector → motor neurone → relay neurone → sensory neurone → receptor

B Effector → sensory neurone → relay neurone → motor neurone → receptor

C Receptor → motor neurone → relay neurone → sensory neurone → effector

D Receptor → sensory neurone → relay neurone → motor neurone → effector

Your answer ☐ **[1]**

11 Which cell does **not** contain a nucleus?

A Red blood cell

B Root hair cell

C Sperm cell

D White blood cell

Your answer ☐ **[1]**

12 Which part of the brain controls heart rate?

A Cerebellum

B Cerebrum

C Medulla

D Pituitary

Your answer ☐ **[1]**

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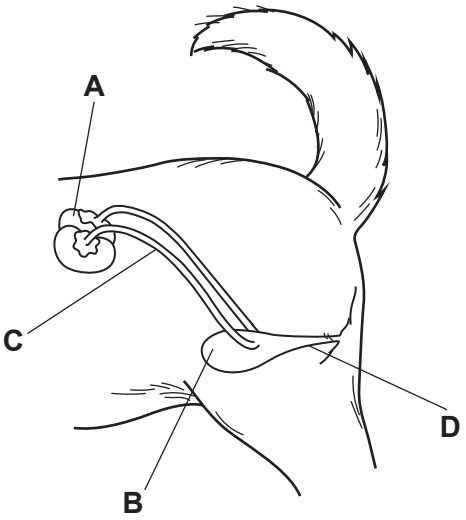
13 The diagram shows a dog's excretory system.

Which labelled part is a **kidney**?



Your answer ☐ **[1]**

14 Which mechanism is used to control **water balance** in the human body?

A Adjusting the glucose concentration of the urine

B Altering the volume of urine produced

C Changing the rate of urea production

D Varying the rate of sweat production

Your answer ☐ **[1]**

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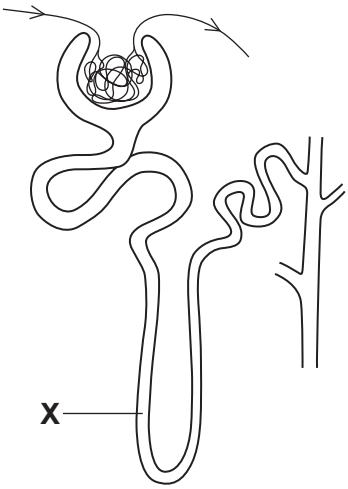
15 The diagram shows a kidney tubule.

What is the structure labelled **X**?



A Bowman's capsule

B Collecting duct

C Glomerulus

D Loop of Henle

Your answer ☐ **[1]**

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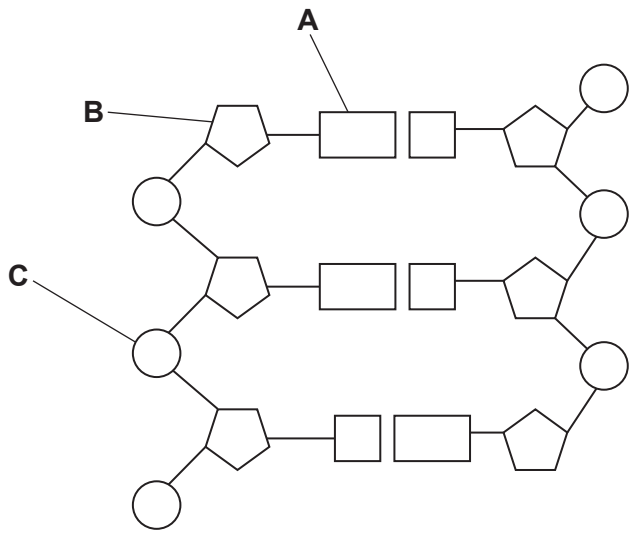
Section B

16 The diagram shows DNA.



(a) Complete the table to show which letter represents each part of DNA.

Part of the DNA	**Letter**
Base	
Phosphate	
Sugar	

[2]

(b) Which words can be used to describe DNA?

Tick (✓) **three** boxes.

- Double helix ☐
- Molecule ☐
- Monomer ☐
- Polymer ☐
- Protein ☐
- Single helix ☐

[3]

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(c) A sample of DNA is analysed.

15% of the bases in the sample are Adenine (A).

Calculate the percentage of the bases that are Guanine (G).

Percentage = ... % **[3]**

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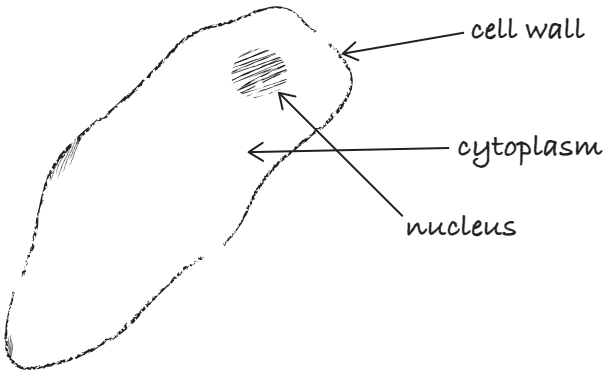
17 A student is observing onion cells using a light microscope.

(a) The student used an objective lens with a magnifying power of ×40 to view the onion cell.
The eyepiece had a magnifying power of ×10.

Calculate the total magnification they used to view the onion cell.

Total magnification used to view the onion cell = ... **[2]**

(b) The student produces a labelled scientific drawing of one onion cell.



Describe **three** ways the student could improve their scientific drawing.

1 .....

2 .....

3 .....

[3]

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(c) Animal and bacterial cells have some cell structures that are the same and some that are different.

Identify which structures are present in each type of cell.

Tick (✓) **one** box in each row.

One has been done for you.

Cell structure	**In animal cells only**	**In bacterial cells only**	**In both animal and bacterial cells**
Ribosome			✓
Nucleus			
Plasmid			
Mitochondria			

[3]

(d) Which cell structure shown in the table is the site of protein synthesis in cells?

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

(e) Substances can move into and out of cells.

Give **two** processes that can move substances into or out of cells.

1 .....

2 .....

[2]

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18 Amylase is an enzyme that is produced by the salivary glands and is released into the mouth in saliva.
In the mouth, amylase begins the breakdown of starch.

(a) What monomers are large carbohydrates such as starch made from?

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

(b) Explain why the enzyme amylase cannot break down the substrate protein.

Include ideas about the active site.

.....

.....

.....

.....

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

(c) Amylase is an enzyme that works best in alkaline conditions.

State what will happen to the structure of the enzyme when it enters the acidic conditions of the stomach.

.....

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

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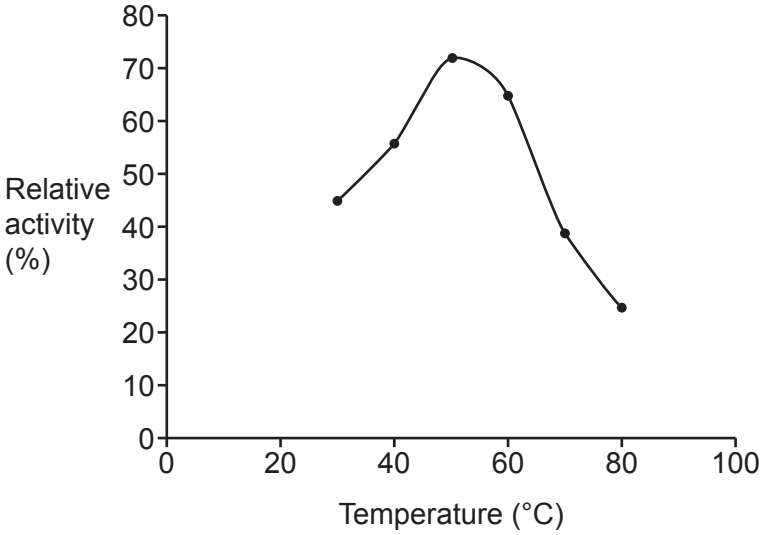
(d) Bacteria also use the enzyme amylase.

The graph shows the results of an experiment to investigate the effect of temperature on the relative activity of this enzyme.



(i) Describe how temperature affects the relative activity of this enzyme.

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

(ii) Describe how this experiment could be improved to determine a more accurate optimum temperature for this enzyme.

.....

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

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19 Hormones are important for human reproduction.

(a) Four human hormones are given below.

FSH **oestrogen** **progesterone** **testosterone**

Identify which hormone fits each of these descriptions.

(i) A hormone that maintains the lining of the uterus.

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

(ii) A hormone that causes the lining of the uterus to thicken.

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

(b) Female sheep (ewes) have a reproductive cycle which is also controlled by hormones.
During their reproductive cycle, ewes will ovulate.
However, in some places ewes do not ovulate throughout the year.

The table shows some information about when ewes ovulate in two different places, Idaho and Texas.

Month	**Ewes ovulating (%)**	
	Idaho	**Texas**
January	100	100
February	100	94
March	94	52
April	32	32
May	2	31
June	7	75
July	6	94
August	41	100
September	100	94
October	94	100
November	100	91
December	100	100

A farmer will introduce a male sheep into a flock of ewes when the ewes are most likely to be ovulating.

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(i) Which **three** months are **least** likely to result in pregnancy for the sheep in Idaho?

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

(ii) Which **two** months would be **most** likely to result in pregnancy for sheep in both Idaho **and** Texas?

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

(iii) Texas is closer to the equator than Idaho.
Sheep that live closer to the equator tend to ovulate all year round.

Explain how the data supports this statement.

.....

.....

.....

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

(iv) Pregnancy in sheep lasts 5 months.

Suggest why sheep in colder climates do **not** ovulate in the summer months.

.....

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

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20 **Fig. 20.1** shows a jackrabbit.

Jackrabbits are adapted to live in the desert where it can be cold at night and very hot during the day.

Fig. 20.1

(a)* Explain how the jackrabbit's body regulates its body temperature during the day.

In your answer include:

- the role of the jackrabbit's skin in keeping cool
- how its ears are adapted to increase heat loss.

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..... **[6]**

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(b) Explain why it is important for the jackrabbit to maintain a constant temperature.

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

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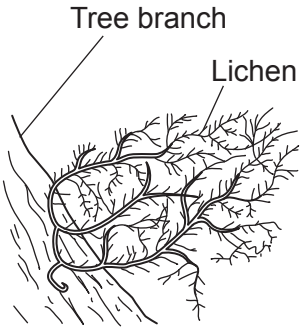
21 The diagram shows a lichen growing on a tree branch.



A lichen is not a single organism but consists of algae and a fungus living together.
Each organism gains something from the other.

The algae in the lichen have chlorophyll. The fungus obtains sugars from the algae.

(a) Explain how the algae produce sugars for the fungus.

.....

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

(b) Explain how the production of sugars in the algae allows the algae to take up water.

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

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22 There are three main types of blood vessel in the circulatory system.

(a) Complete this table by:

- writing the missing types of blood vessel
- putting a tick (✓) or a cross (✗) to identify the two missing characteristics.

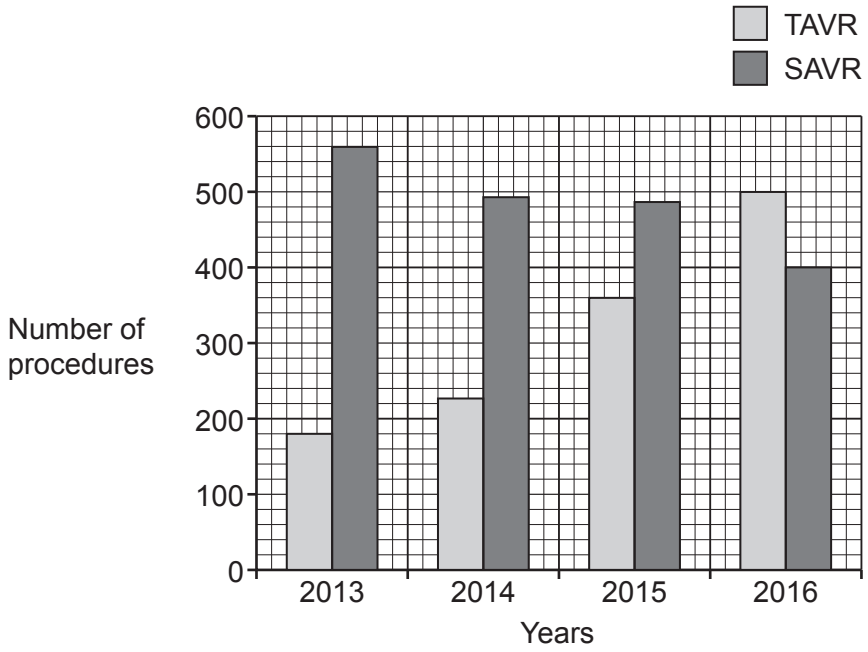
Characteristic	**Type of blood vessel**		
	.....	**Vein**	.....
Valves along their length	✗	✓	.....
Wall one cell thick	✗	.....	✓

[3]

(b) Valves in the aorta sometimes need replacing.
There are two procedures that doctors can use to replace these valves.
They are called TAVR and SAVR.

Fig. 22.1 shows the numbers of each of these two procedures that took place in Finland between 2013 and 2016.

Fig. 22.1



(i) Calculate the percentage of all the replacements in 2016 that used the TAVR procedure.
Give your answer to **1** decimal place.

Percentage using TAVR procedure = ... % **[4]**

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(ii) After valve replacement, patients can develop kidney damage or have strokes.

The table shows the percentage of patients that develop kidney damage or strokes after each type of procedure.

	Percentage of patients developing	
	Kidney damage	**Strokes**
After TAVR	0.5	2.5
After SAVR	2.5	4.0

Use the data in the table to explain the changes in the percentage of patients having each type of procedure shown in **Fig. 22.1**.

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

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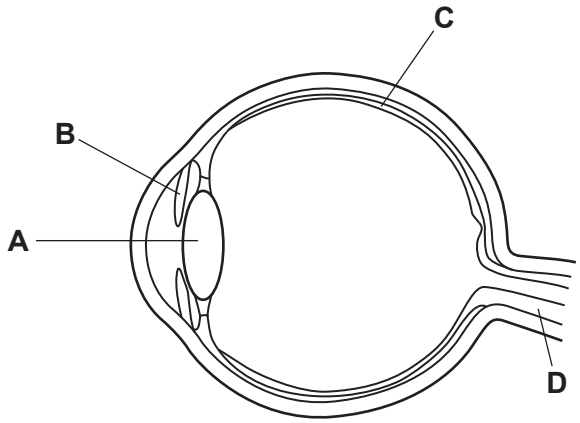
23 The diagram shows the human eye.



(a) State which letter in the diagram performs each of the following functions:

Controls the size of the pupil .....

Focuses the light on the retina .....

Transmits electrical impulses to the brain .....

Detects light .....

[3]

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(b) Short-sightedness is a condition that causes the light entering the eye to be focused before it reaches the retina.

Opticians measure the focusing power of the eye in dioptres (D).
It is written as a minus number and indicates how short-sighted you are.

	Focusing power in dioptres (D)
Low short-sightedness	less negative than –3.0
Mild short-sightedness	–3.0 to –4.0
Moderate short-sightedness	–4.1 to –6.0
High short-sightedness	more negative than –6.0

(i) A student has an eye test.
The optician tells the student that the focusing power of their eyes is –3.5 dioptres.

Explain to the student what this result means and how it is likely to be treated.

.....

.....

.....

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

(ii) Once short-sightedness has developed, it usually gets worse.

Another student has a focusing power of –1.0 D which is changing by –0.5 D per year.
Using a drug called atropine will reduce the change to –0.2 D per year.

Calculate how many **more** years it will take for them to develop **mild short-sightedness** if they use the drug compared to not using the drug.

Number of years more = ... **[2]**

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24 A student is investigating mitosis in garlic roots.

The student grows some garlic for 10 days as shown in **Fig. 24.1** and removes a root.

The student takes a sample of tissue from four parts of the root, **A**, **B**, **C** and **D**, as shown in **Fig. 24.2**.

Fig. 24.1

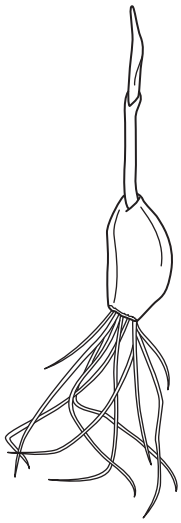
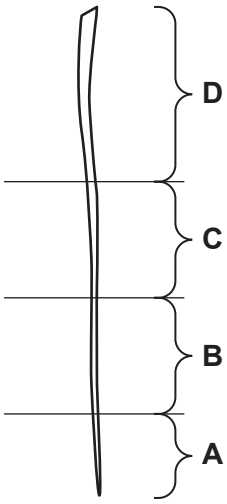


Fig. 24.2



(a) The student prepares a slide to look for mitosis in the different parts of the root.
The student adds a stain when preparing the slide.

Explain why the student adds a stain to look for mitosis.

.....

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

(b) The student uses a light microscope to look at the garlic root cells on the prepared slide.

Describe how the student would set up the microscope so that the details of the garlic root cells are clearly visible.

.....

.....

.....

.....

.....

.....

..... **[4]**

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(c) The student takes two measurements when observing the cells under the microscope:

- the total number of cells in the field of view
- the number of cells in the field of view that are undergoing mitosis.

The results are in the table.

Part of the root	Total number of cells in field of view	Number of cells undergoing mitosis in field of view	Percentage of cells undergoing mitosis in field of view (%)
A	120	.....	75
B	125	55	44
C	88	0	0
D	78	0	0

Calculate the number of cells undergoing mitosis in the field of view in part **A**.

Number of cells = ... **[2]**

(d) The student concludes that only cells found in certain parts of the root can divide by mitosis.

How does the data in the table support their conclusion?

.....

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

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(e) The student wants to improve their experiment to:

- make a more accurate conclusion about where cells in the root can divide by mitosis
- check that their results are reproducible.

Draw **two** lines to connect each **improvement** with **how it can be achieved**.

Improvement	**How it can be achieved**
	Compare the results with other students' results.
Make a more accurate conclusion.	
	Use a lower magnification so that more cells can be counted.
Check that the results are reproducible.	
	Sample from more points in regions **A** and **B**.

[2]

(f) Cells located in region **D** differentiate to form a tissue responsible for translocation.

State the name of this tissue.

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

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

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