OXFORD
INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____
I declare this is my own work.

INTERNATIONAL A-LEVEL
BIOLOGY (9610)

Unit 4 Control

Thursday 16 January 2020 07:00 GMT Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Do not write outside the box

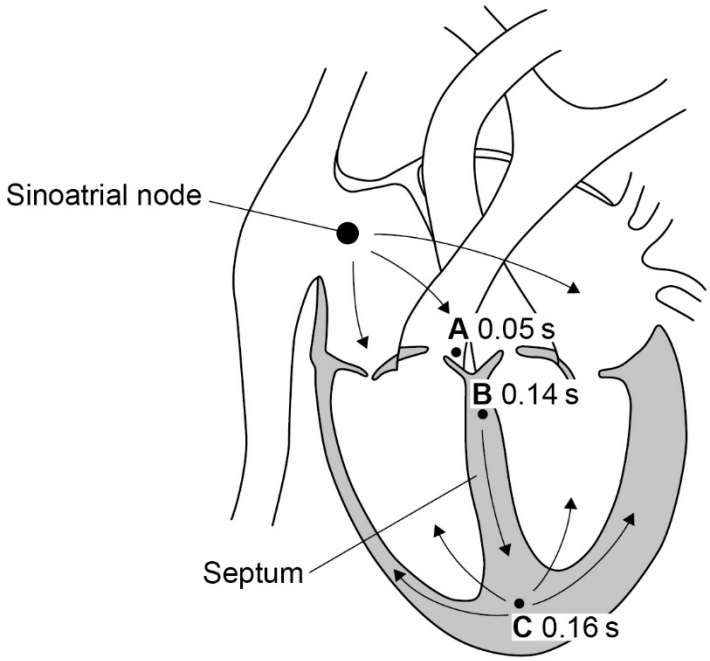
Answer **all** questions in the spaces provided.

0 1 Heart rate is controlled by the sinoatrial node (SAN). A wave of electrical activity spreads from the SAN and co-ordinates the heartbeat.

Figure 1 shows how a wave of electrical activity spreads from the SAN across the heart.

The numbers show the time, in seconds, for the wave of electrical activity to spread from the SAN to each point.

Figure 1



0 1 . 1 The magnification of the drawing in **Figure 1** is × 0.8

Calculate the actual distance from point **B** to point **C**.

[2 marks]

Answer = _____ mm

Do not write outside the box

0 1 . 2 Calculate the speed of the wave of electrical activity as it passes from point **B** to point **C**.

Use your answer to Question **01.1** and the times shown on **Figure 1**.

Give your answer in ms^{-1} to 3 significant figures.

[2 marks]

Answer = _____ ms^{-1}

0 1 . 3 Point **A** on **Figure 1** represents the atrioventricular node (AVN).

Name the structure in the septum that conducts the waves of electrical activity from the AVN to point **C**.

[1 mark]

_____

0 1 . 4 Explain how an increase in the concentration of carbon dioxide in the blood causes an increase in heart rate.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

8

Turn over ►

Do not write outside the box

0 2 Neurones conduct nerve impulses.

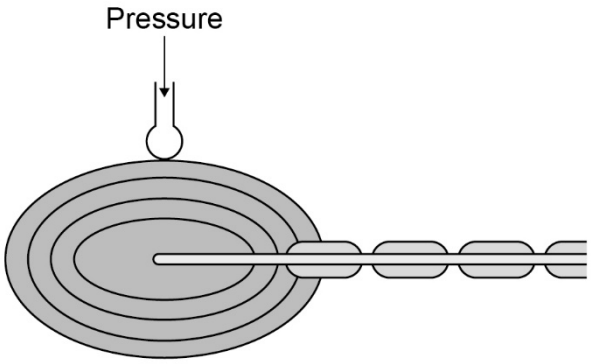
When it is **not** conducting an impulse, a neurone has a resting potential of –70 mV

0 2 . 1 Describe how the resting potential is maintained.

[2 marks]

Figure 2 shows a pressure receptor called a Pacinian corpuscle.

Figure 2



0 2 . 2 Describe what happens when pressure is applied at the point shown.

[2 marks]

Do not write outside the box

Question 2 continues on the next page

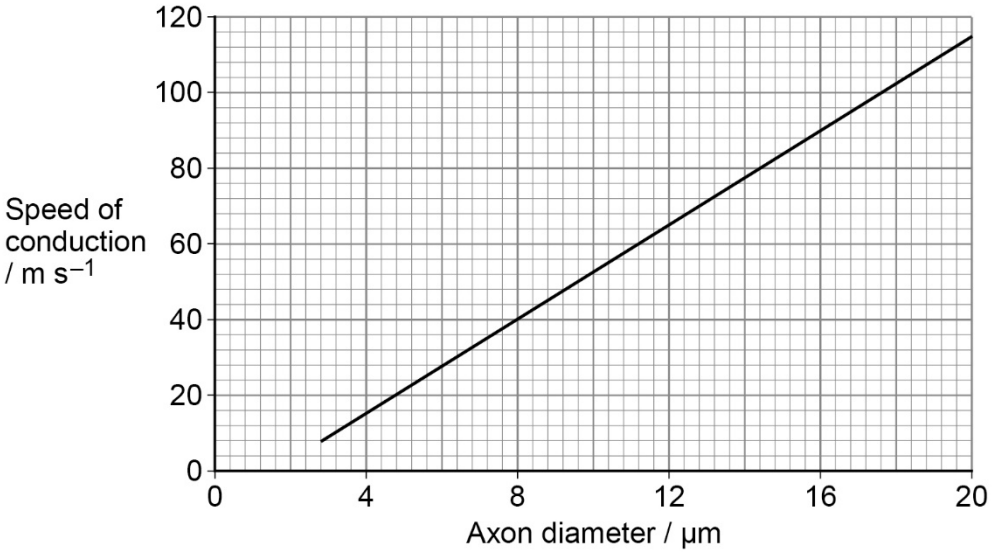
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Different neurones have axons with different diameters.

Figure 3 shows the relationship between the diameter of an axon and the speed of conduction of nerve impulses in myelinated axons.

Figure 3



0 2 . 3 Calculate the percentage increase in the speed of conduction in a 16 μm axon compared with an 8 μm axon.

Use data from **Figure 3**.

[2 marks]

Percentage increase = _____ %

Do not write outside the box

0 2 . 4 In a myelinated neurone, there are gaps in the myelin sheath called nodes of Ranvier. In axons with a larger diameter, the distance between the nodes along the length of the neurone is longer.

Explain how a longer distance between the nodes could cause the faster speed of conduction shown in **Figure 3**.

[2 marks]

0 2 . 5 Explain how the Pacinian corpuscle allows an organism to distinguish between different levels of pressure.

[2 marks]

10

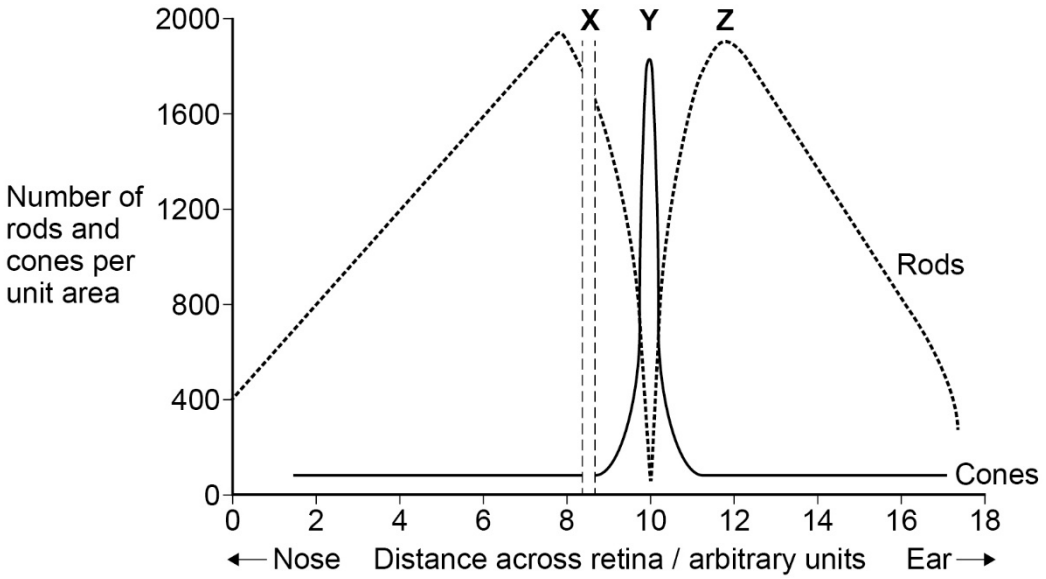
Turn over for the next question

Do not write outside the box

0 3 The retina of the eye is sensitive to different intensities and colours (wavelengths) of light.

Figure 4 shows the distribution of rods and cones across the retina of a human eye.

Figure 4



0 3 . 1 An image of an object is formed at point **X** on the retina.

State why this image cannot be seen.

[1 mark]

0 3 . 2 Explain why an image formed at point **Y** is seen in more detail than an image formed at point **Z**.

[2 marks]

Do not write outside the box

An image of a dim red star is formed at point **Z**.

0 3 . 3 Explain why the star is more likely to be seen than if the image is formed at point **Y**.

[2 marks]

0 3 . 4 State why the colour of the star could not be determined by the brain.

[1 mark]

Question 3 continues on the next page

Do not write outside the box

A moth is a type of flying insect that pollinates flowers.

Figure 5 shows the absorption spectra for light-sensitive cells in the retina of a species of moth and for cone cells in the human retina.

Figure 5

This source cannot be reproduced here due to third party copyright restrictions.

0 3 . 5 Give **one** similarity and **one** difference between the absorption spectrum of light-sensitive cells in moths and the absorption spectrum of cone cells in humans.

Use data from **Figure 5** in your answer.

[2 marks]

Similarity _____

_____

_____

Difference _____

_____

_____

Different species of moths show different colour preferences when they visit flowers to feed.

0 3 . 6 Scientists want to determine the colour preferences of a certain species of moth under experimental conditions.

Describe a method the scientists could use.

[2 marks]

_____

_____

_____

_____

_____

_____

Do not write outside the box

0 3 . 7 Name an appropriate statistical test the scientists could use to analyse their results.

[1 mark]

_____

11

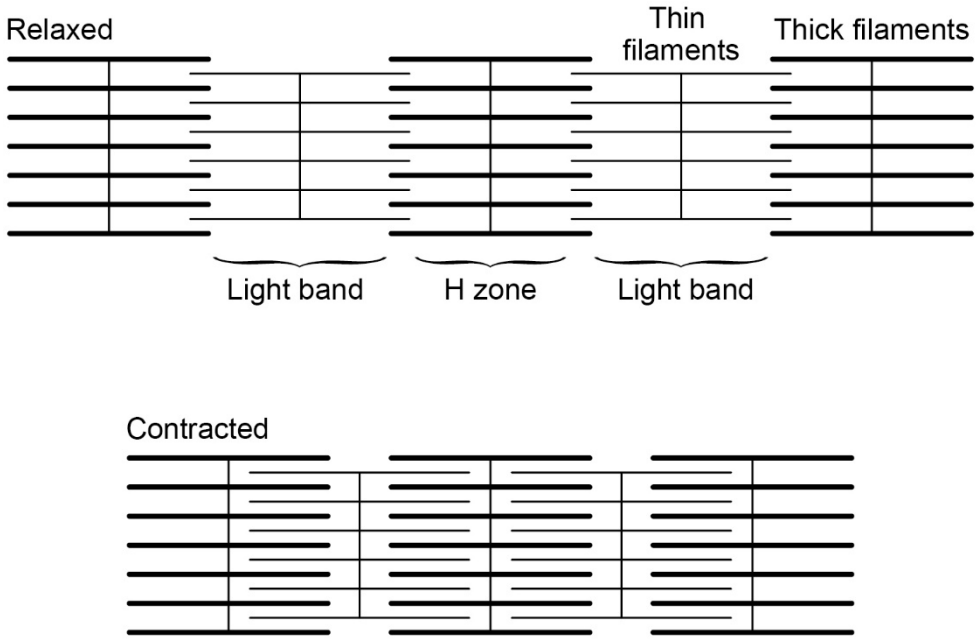
Turn over for the next question

Do not write outside the box

0 4 A muscle fibre contains myofibrils. A myofibril contains two types of protein filament, thick filaments and thin filaments.

Figure 6 shows a section of a muscle myofibril when the muscle is relaxed and when the muscle is contracted.

Figure 6



0 4 . 1 Give **two** differences in the appearance of the myofibril when the muscle is contracted compared with when it is relaxed in **Figure 6**.

[1 mark]

1 _____

_____

2 _____

_____

0 4 . 2 When muscles contract they shorten.

State how a shortened muscle is returned to its non-contracted length, as shown in **Figure 6**.

[1 mark]

_____

_____

_____

Do not write outside the box

Figure 7 shows the two types of protein filaments in more detail.

Figure 7

This source cannot be reproduced here due to third party copyright restrictions.

0 4 . 3 Describe how the filaments move during muscle contraction.

Use your own knowledge and information from **Figure 7**.

[5 marks]

7

Do not write outside the box

0 5 The concentration of glucose in human blood is controlled by hormones.

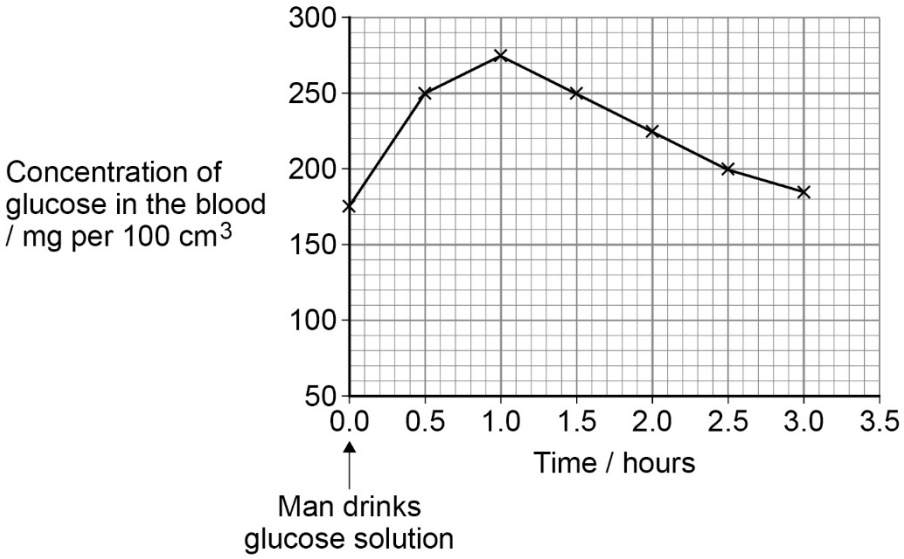
0 5 . 1 Describe how the hormone insulin reduces the concentration of glucose in the blood.

[3 marks]

People who cannot produce insulin have a condition called Type 1 diabetes.
In an investigation, a man with Type 1 diabetes drinks a glucose solution.
The concentration of glucose in his blood is measured every half-hour for 3 hours.

Figure 8 shows the results of the investigation.

Figure 8



Do not write outside the box

0 5 . 2 Use **Figure 8** to calculate the rate of decrease in glucose concentration between 1 and 1.5 hours.

Give your answer to 3 significant figures in μg s^{-1}

[2 marks]

Rate of decrease = _____ μg s^{-1}

0 5 . 3 Suggest **two** reasons why the glucose concentration in the man's blood decreased.

[2 marks]

1 _____

_____

2 _____

_____

Question 5 continues on the next page

Do not write outside the box

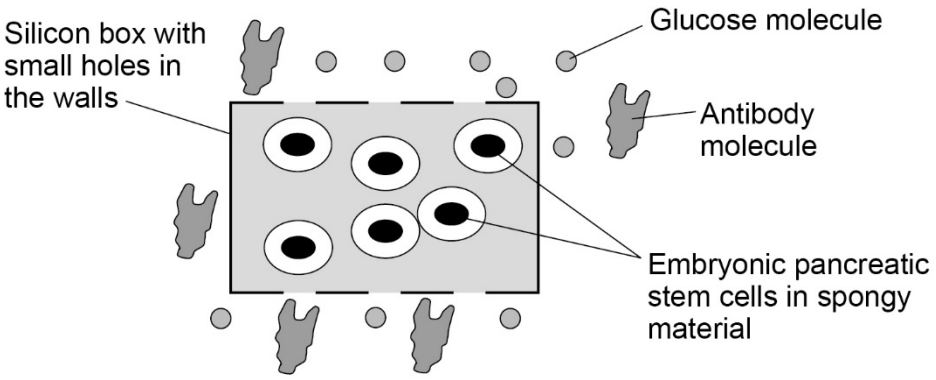
Many people with Type 1 diabetes have to inject themselves regularly with insulin to control their blood glucose levels.

Scientists have transplanted embryonic pancreatic stem cells into some people with Type 1 diabetes.

However, the transplanted cells are often destroyed by the person's immune system.

Figure 9 shows a new type of transplant that has been tested on rats.

Figure 9



0 5 . 4 The type of transplant shown in **Figure 9** is able to cause a reduction in blood glucose concentration, but is not destroyed by the rat's immune system.

Explain why.

[3 marks]

Do not write outside the box

0 5 . 5 Suggest **two** possible advantages and **two** possible disadvantages of using the type of transplant shown in **Figure 9** for humans.

[4 marks]

Advantage 1 _____

_____

_____

Advantage 2 _____

_____

_____

Disadvantage 1 _____

_____

_____

Disadvantage 2 _____

_____

_____

14

Turn over for the next question

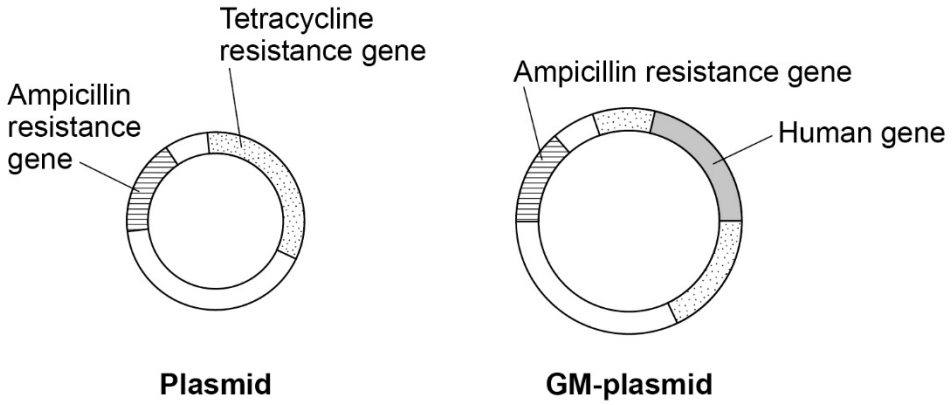
Do not write outside the box

0 6 Bacteria can be genetically modified to make a human gene product.

A human gene is combined with a bacterial plasmid to produce a genetically-modified (GM) plasmid.
The plasmid contains genes for resistance to two antibiotics, ampicillin and tetracycline.
The human gene is inserted into the middle of the gene for tetracycline resistance.

Figure 10 shows the bacterial plasmid and the genetically-modified (GM) plasmid.

Figure 10



0 6 . 1 Describe how the gene is removed from a human chromosome and inserted into the bacterial plasmid.

[3 marks]

0 6 . 2 **Figure 10** shows the human gene inserted into the middle of the gene for tetracycline resistance.

Give the reason why the gene for tetracycline resistance in the GM-plasmid is no longer functional.

[1 mark]

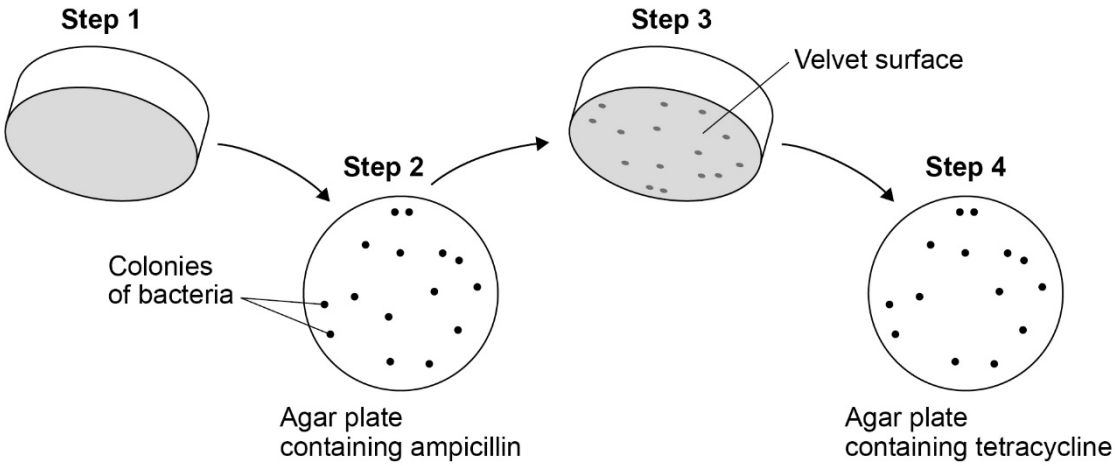
Do not write outside the box

The GM-plasmids are added to a culture of bacteria.

Replica plating is used to identify which of the bacteria have the plasmid containing the human gene.

Figure 11 shows the method used in replica plating.

Figure 11



0 6 . 3 Explain why each of the following was used:

- the velvet surface
- the agar plate containing ampicillin
- the agar plate containing tetracycline.

[5 marks]

Velvet surface _____

_____

Agar plate containing ampicillin _____

_____

_____

Agar plate containing tetracycline _____

_____

_____

0 6 . 4 Draw a circle on **Figure 11** around the colony containing the human gene.

[1 mark]

10

Turn over ►

Do not write outside the box

0 7 The roots and shoots of plant seedlings respond to gravity and to the direction of light.

These responses to gravity and light are controlled by plant growth substances called auxins.

Scientists investigate the response of pea seedlings to different concentrations of an auxin called IAA.

The scientists use different concentrations of IAA and measure the responses of the roots and shoots.

Figure 12 shows the scientists' results.

Figure 12

This source cannot be reproduced here due to third party copyright restrictions.

Do not write outside the box

0 7 . 1 Why is a logarithmic scale used for IAA concentration?

[1 mark]

0 7 . 2 Describe the effect that a concentration of 1 part per million of IAA has on roots and shoots.

Use data from **Figure 12**.

[2 marks]

Roots

Shoots

0 7 . 3 The seedlings were placed horizontally.

Explain how IAA causes the roots and shoots to respond to gravity.

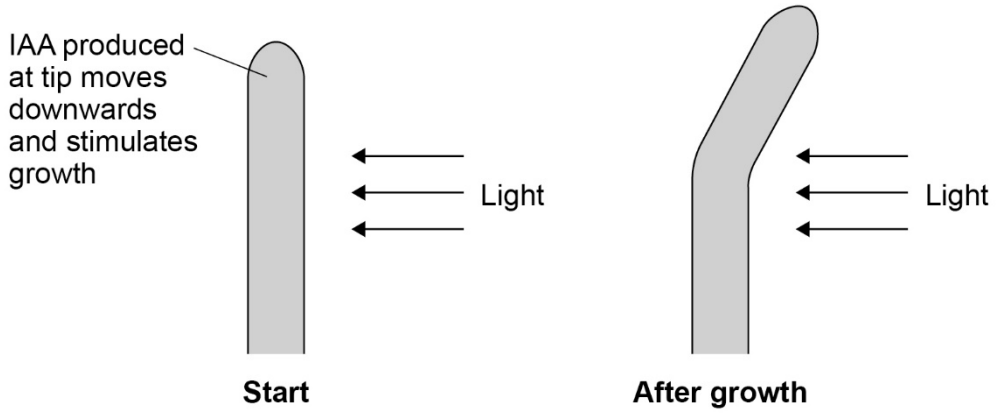
[3 marks]

Question 7 continues on the next page

Do not write outside the box

Figure 13 shows a shoot of a seedling growing towards light.

Figure 13



Scientists investigate two hypotheses to explain this growth response.

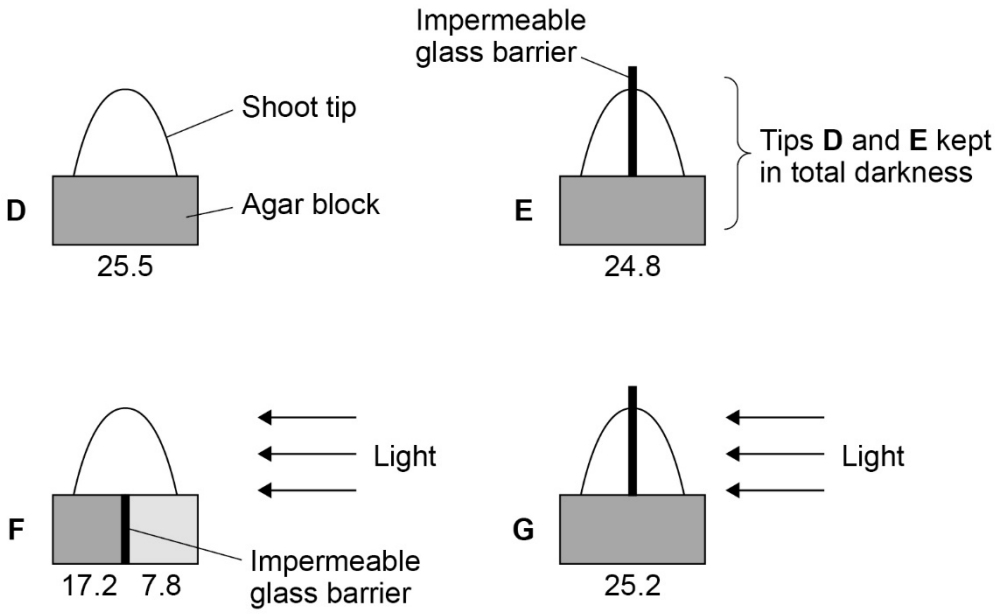
Hypothesis 1 IAA is broken down by light on the side of the shoot facing the light.

Hypothesis 2 IAA moves from the side of the shoot facing the light to the shaded side of the shoot.

Scientists do four experiments using shoot tips to determine which of the two hypotheses is correct. Shoot tips are removed and placed on agar blocks for 24 hours.

Figure 14 shows the results of the four experiments.

Figure 14



The numbers under each block represent the amount of IAA (in arbitrary units) that has diffused into the block from the shoot tip.

Do not write outside the box

0 7 . 4 Suggest **one** control variable needed for the four experiments.

[1 mark]

_____

0 7 . 5 Give **one** way the results of these experiments provide evidence:

- against **hypothesis 1**
- for **hypothesis 2**.

[2 marks]

Against **hypothesis 1** _____

_____

_____

For **hypothesis 2** _____

_____

_____

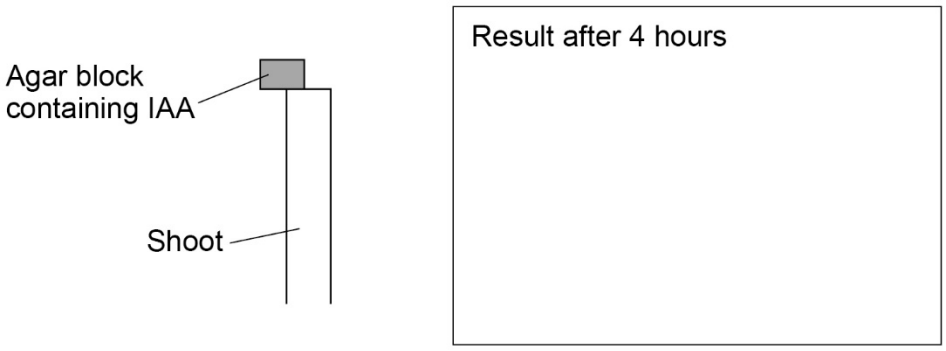
0 7 . 6 A scientist:

- removes the tip from the shoot of a seedling
- puts an agar block containing IAA on the cut end of the shoot as shown in **Figure 15**
- leaves the seedling in the dark for 4 hours.

Draw a diagram in the box to show how the shoot of the seedling will grow.

[1 mark]

Figure 15

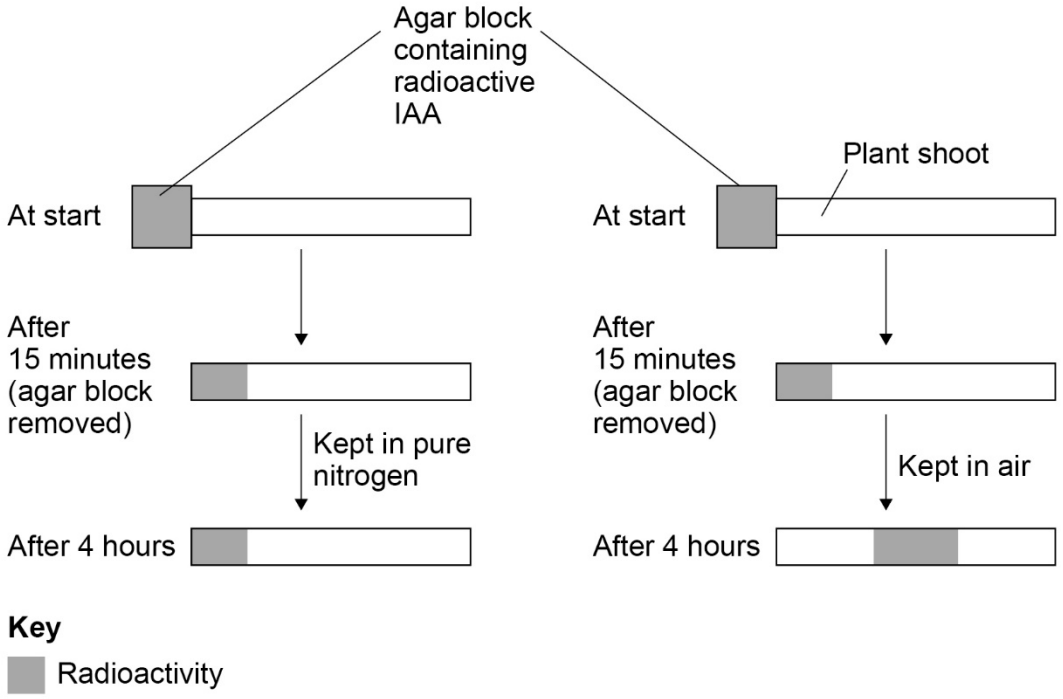


Question 7 continues on the next page

Do not write outside the box

Figure 16 shows how IAA moves through two plant shoots. One shoot is kept in pure nitrogen and the other shoot is kept in air.

Figure 16



0 7 . 7 IAA is an organic substance.

Suggest a suitable radioactive element to label IAA in this investigation.

[1 mark]

_____

0 7 . 8 Suggest why one of the plant shoots is kept in pure nitrogen.

[1 mark]

_____

_____

Do not write outside the box

0 7 . 9 Explain what the results of this investigation suggest about the processes involved in the movement of IAA through plant shoots.

[3 marks]

15

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.oxfordaqaexams.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and Oxford International AQA Examinations will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2020 Oxford International AQA Examinations and its licensors. All rights reserved.