

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 5 Synoptic paper

Monday 19 January 2026

07:00 UK Time

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	
TOTAL	



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

Do not write
outside the
box

0 1

Scientists study the structure of skeletal muscle using optical microscopes and electron microscopes.

Figure 1 shows relaxed skeletal muscle fibres as seen using an optical microscope.

Figure 1

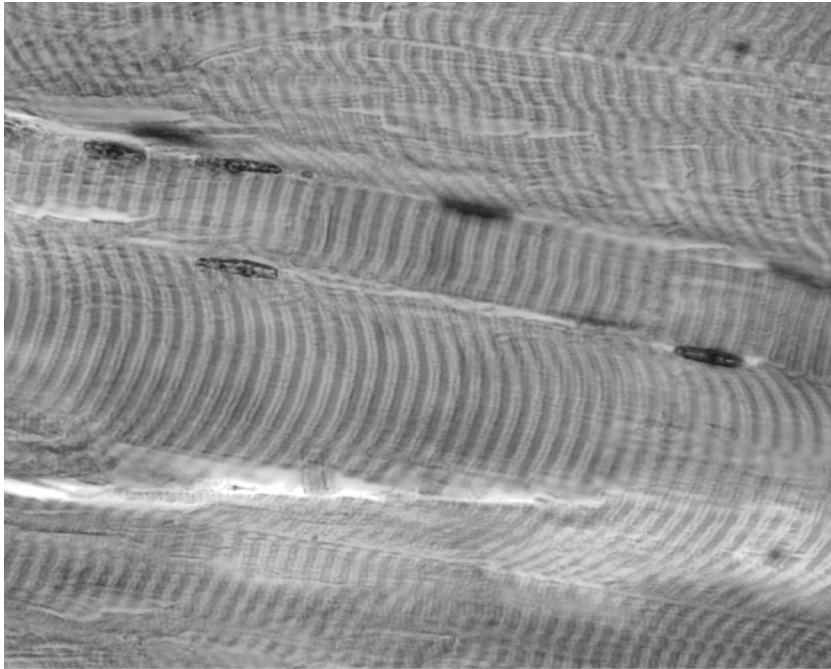
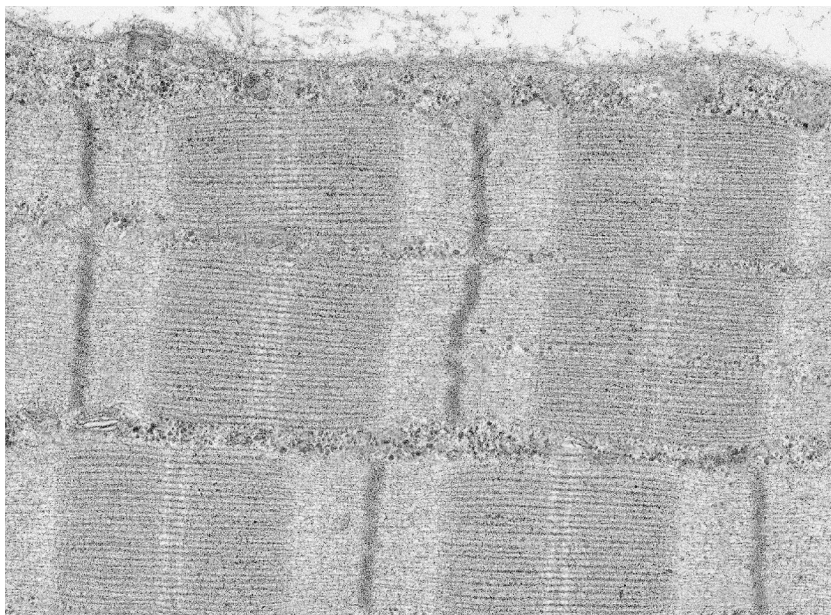


Figure 2 shows part of a relaxed skeletal muscle fibre as seen using an electron microscope.

Figure 2



0 1 . 1 **Figure 2** is magnified more than **Figure 1**.

Calculate how many times more.

Give your answer to the nearest whole number.

[3 marks]

Figure 2 is magnified _____ times more

0 1 . 2 Draw a large, clear diagram of **one** sarcomere in **Figure 2**.

[3 marks]

0 1 . 3 **Figure 2** shows more details of the structure of the muscle than **Figure 1**.

Explain why.

[2 marks]

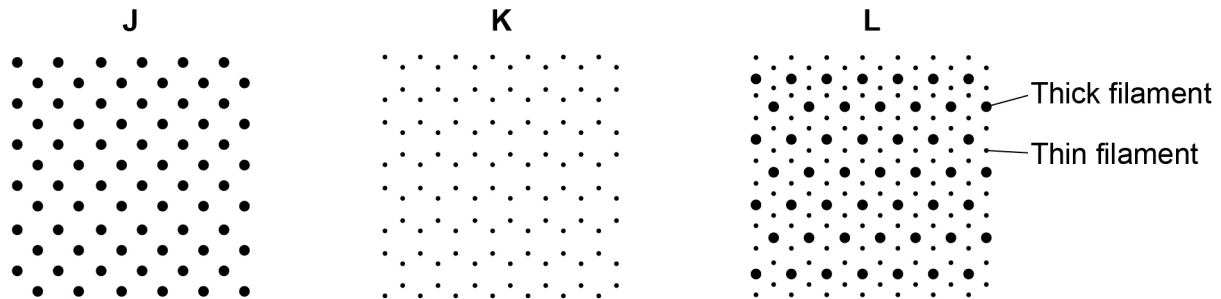
Turn over ►



Figure 3 show sections cut across three different parts of a relaxed myofibril from **Figure 2**.

Figure 3 shows the arrangement of thick and thin filaments in the sections.

Figure 3



0 1 . 4 When the myofibril is fully contracted, **one** of the arrangements, **J**, **K** or **L** cannot be seen.

Which arrangement, **J**, **K** or **L**, cannot be seen?

[1 mark]

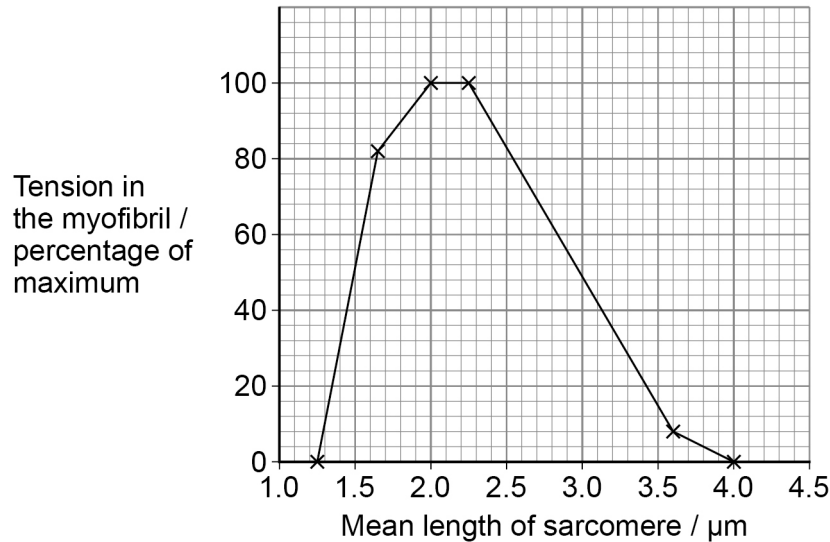
0 1 . 5 Explain your answer to Question **01.4**.

[2 marks]

Tension is the pulling force generated by a muscle when it contracts.

Figure 4 shows how the length of the sarcomeres in a myofibril affects the tension developed in the myofibril.

Figure 4



0 1 . 6

What percentage of the maximum tension is developed when the mean length of the sarcomeres is $2.6 \mu\text{m}$?

[1 mark]

Percentage of maximum tension = _____ %

0 1 . 7

Figure 4 shows that when the mean length of the sarcomeres is less than $2.0 \mu\text{m}$, the tension in the myofibril decreases.

Explain what causes the tension to decrease.

[2 marks]

Turn over for the next question



0 2

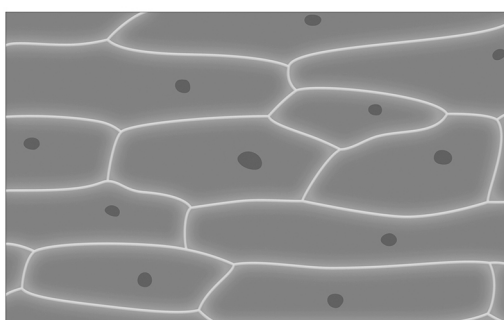
The surface layer of cells on a plant leaf is called the epidermis.

Students investigate the effect of different concentrations of sucrose solution on epidermis cells.

The students use a range of concentrations of sucrose solution.

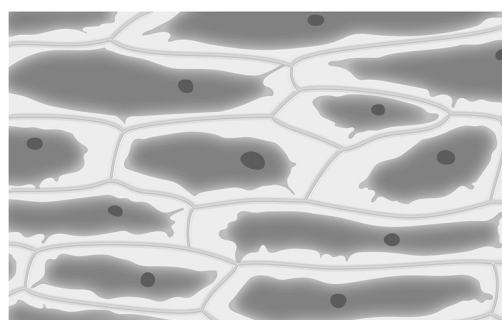
- In some of the concentrations of sucrose, the epidermis cells look like those in **Figure 5**.
- In some concentrations of sucrose, the epidermis cells look like those in **Figure 6**.
- In other concentrations of sucrose, some epidermis cells look like those in **Figure 5** and some look like those in **Figure 6**.

Figure 5



Turgid cells

Figure 6



Plasmolysed cells

There are different percentages of turgid and plasmolysed cells in the different concentrations of sucrose solution.

Table 1 shows the students' results for epidermis cells in water and in five different concentrations of sucrose solution.

Table 1

Concentration of sucrose solution / mol dm ⁻³	Mean percentage of plasmolysed cells
0.0	0
0.2	5
0.4	62
0.6	98
0.8	100
1.0	100



You are given some 1.0 mol dm^{-3} sucrose solution.

[7 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Turn over ►



Table 1 is repeated below.

Table 1

Concentration of sucrose solution / mol dm ⁻³	Mean percentage of plasmolysed cells
0.0	0
0.2	5
0.4	62
0.6	98
0.8	100
1.0	100

0 2 . 2 Describe how you would plot a graph of the results in **Table 1**.

Give the reason for your choice of graph.

[3 marks]



At one concentration of sucrose solution, the epidermis cells will have the same water potential as the solution outside the cells.

At this concentration, the cell-surface membrane will just touch the cell wall but will **not** put any pressure on the wall.

0 2 . 3

Give the reason why it is **not** possible to find a cell's water potential only by looking at the cell in sucrose solutions with a microscope.

[1 mark]

0 2 . 4

To estimate the water potential of the epidermis cells, you could use the graph you described in Question **02.2**.

At one concentration of the sucrose solution, 50% of the epidermis cells will be plasmolysed. This concentration of sucrose solution will have the same water potential as the mean water potential of the cells.

Explain why this is a valid method for estimating the mean water potential of the cells.

[2 marks]

0 2 . 5

Suggest an **approximate** concentration of sucrose solution that would have the same water potential as the epidermis cells.

Use information from **Table 1**.

[1 mark]

_____ mol dm⁻³

14

Turn over for the next question

Turn over ►

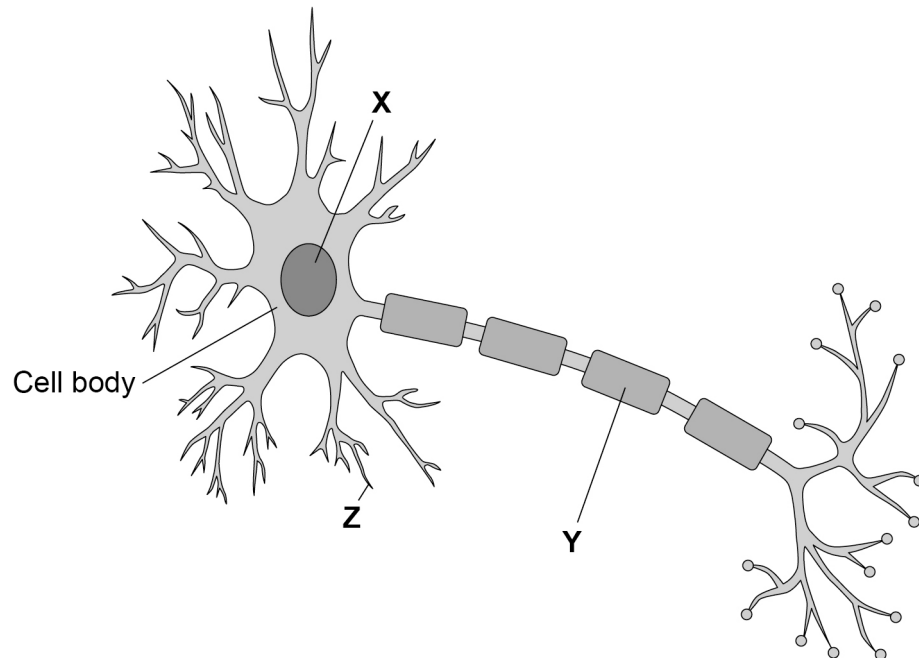


0 3

Neurones conduct nerve impulses.

Figure 7 shows the structure of a motor neurone.

Figure 7

**0 3 . 1**

Name structures **X**, **Y** and **Z**.

[2 marks]

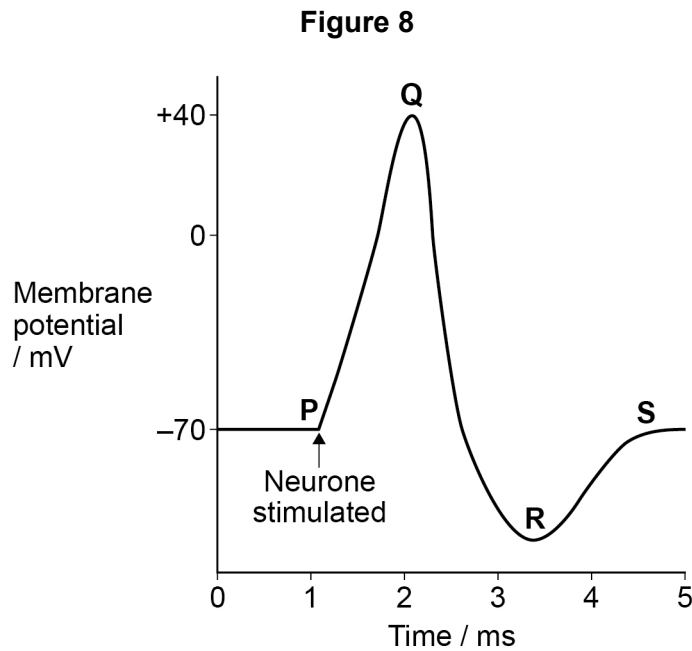
X _____

Y _____

Z _____



Figure 8 shows the changes in membrane potential in a motor neurone during an action potential.



0 3 . 2

Explain how the movement of ions across the membrane of the neurone causes the changes in membrane potential shown in **Figure 8** between **P**, **Q**, **R** and **S**.

[3 marks]

P to Q

Q to R

R to S

5

Turn over for the next question

Turn over ►



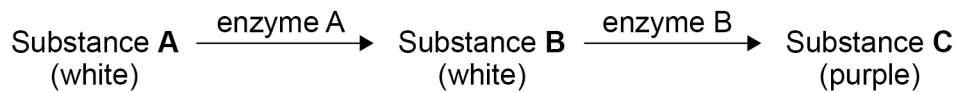
0 4

There are several different varieties of sweet pea plants (*Lathyrus odoratus*).

Some varieties have white flowers. Some other varieties have purple flowers.

Figure 9 shows how the production of the purple pigment depends on the activity of two enzymes.

Figure 9



The gene for enzyme A has two alleles:

A = dominant allele for active enzyme A

a = recessive allele for an inactive enzyme A

The gene for enzyme B also has two alleles:

B = dominant allele for active enzyme B

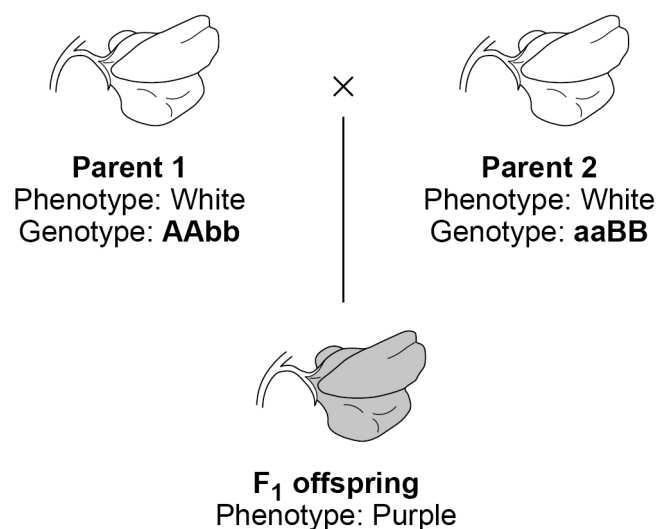
b = recessive allele for an inactive enzyme B

A scientist crosses two different varieties of white-flowered sweet pea plants.

All the F₁ offspring plants have purple flowers.

Figure 10 shows this cross.

Figure 10



0 4 . 1 Explain why **Parent 1** and **Parent 2** each have white flowers.

Use information from **Figure 9** and **Figure 10**.

[2 marks]

Parent 1 _____

Parent 2 _____

0 4 . 2 Explain why the **F₁ offspring** have purple flowers.

[2 marks]

Question 4 continues on the next page

Turn over ►



The scientist then crosses two of the purple-flowered F_1 offspring plants.

The scientist collects the seeds and grows the next generation (F_2) plants from them.

The scientist expects that some of the F_2 plants will have white flowers and some will have purple flowers, in the ratio:

$$\text{purple} : \text{white} = 9 : 7$$

0 4 . 3

Complete the Punnett square genetic diagram in **Figure 11** to show how the expected ratio of 9 purple : 7 white would be produced.

Use the symbols **A/a** and **B/b** for alleles, as defined on page 12.

When completing **Figure 11**, show the phenotype of each offspring genotype by adding the following symbols:

P = purple flowers

W = white flowers.

[3 marks]

Figure 11

Male gametes →				
Female gametes ↓				

The total number of F_2 plants is 128.

0 4 . 4

Explain why it is useful to have large numbers of offspring in genetic investigations.

[2 marks]



0 4 . 5 The F₂ generation has 62 plants with purple flowers and 66 plants with white flowers.

The scientist uses the χ^2 (chi-squared) test to analyse the results.

The scientist calculates a value of $\chi^2 = 3.17$

Table 2 gives probability values for different values of χ^2

Table 2

Degrees of freedom	Probability value					
	0.99	0.95	0.10	0.05	0.01	0.001
1	0.0002	0.0039	2.71	3.84	6.63	10.83
2	0.020	0.103	4.61	5.99	9.21	13.82
3	0.115	0.352	6.25	7.81	11.34	16.27
4	0.297	0.711	7.78	9.49	13.28	18.47

Explain if the scientist's results fit the expected ratio.

Use the calculated value of $\chi^2 = 3.17$ and data from **Table 2**.

[3 marks]

12

Turn over for the next question

Turn over ►



0 5

Cortisol is a hormone released in response to stress.

A high cortisol concentration in the blood can cause:

- fat to be stored in cells
- increased appetite, especially for sweet, fatty and salty foods.

This may cause obesity (being very overweight).

Exercise reduces obesity, lowers stress and improves health.

Scientists investigate the effect of exercise on:

- cortisol concentration in the blood
- heart rate.

The scientists put 21 obese young women randomly into 3 groups.

Table 3 gives mean values $\pm$ standard deviations for some features of the women in each group at the start of the investigation.

Table 3

Feature	Group 1	Group 2	Group 3
Age / years	21.86 ± 1.35	22.00 ± 1.41	21.86 ± 1.35
Percentage body fat / %	45.50 ± 2.89	43.53 ± 4.01	45.01 ± 3.54
Maximum blood pressure / kPa	15.38 ± 0.61	15.18 ± 0.56	15.27 ± 0.49
Resting heart rate / min^{-1}	78.71 ± 7.89	80.86 ± 4.08	79.57 ± 2.58
Blood cortisol / $\mu\text{g dm}^{-3}$	325.13 ± 225.42	337.52 ± 215.01	331.33 ± 138.22

Group 1 do **no** exercise. This is the **control** group.

Group 2 do intervals of aerobic exercise: 6 minutes of medium-intensity running and then 1 minute of low-intensity running, repeated 5 times.

Group 3 do continuous aerobic exercise: 30 minutes of medium-intensity running.



- blood cortisol concentrations before exercise and 10 minutes after the end of exercise
- heart rates before exercise, during exercise and 10 minutes after the end of exercise.

Use information from **Table 3** in your answer.

[6 marks]

[illegible]

Turn over ►



Figure 12 shows the results for blood cortisol concentrations measured before and after exercise. The error bars show $\pm$ standard deviations.

Figure 12

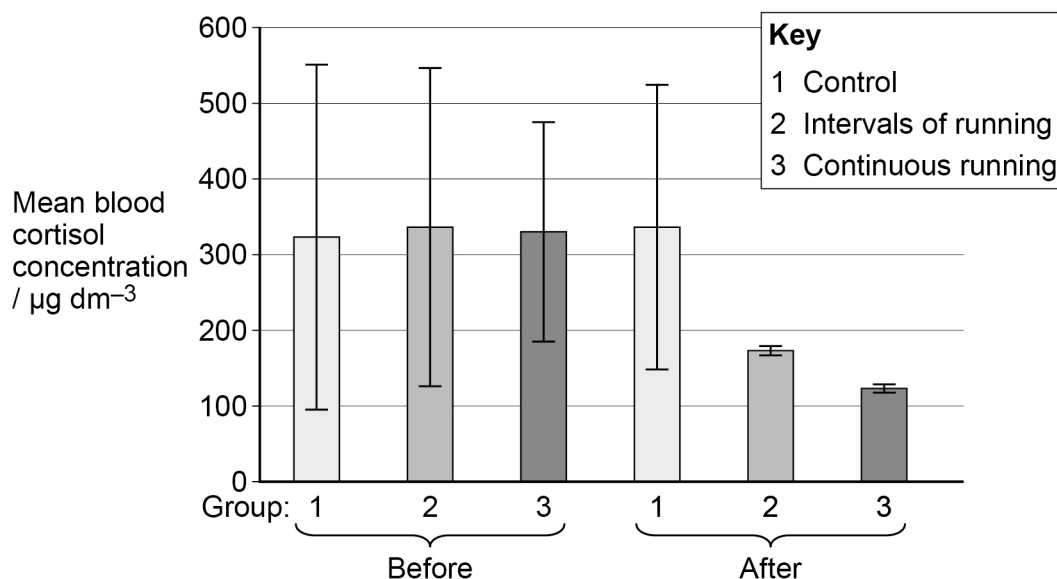
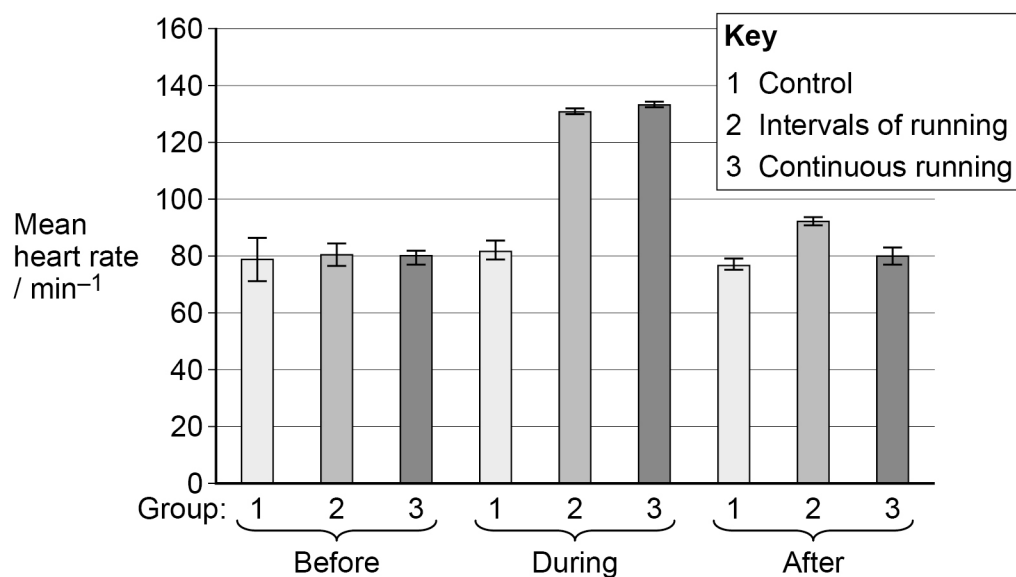


Figure 13 shows the results for heart rate measured before, during and after exercise.

The error bars show $\pm$ standard deviations.

Figure 13



Doctors consider healthy blood cortisol concentrations to be in the range 100 to 200 $\mu\text{g dm}^{-3}$

Based on the results of the investigation, the scientists recommend that obese young women should have a programme of continuous medium-intensity exercise to increase fitness and reduce obesity.

Give evidence for the scientists' conclusion from **Figure 12** and **Figure 13**.

[4 marks]

[illegible]

10

Turn over for the next question

Turn over ►



0	6
---	---

0	6	.	1
---	---	---	---

[7 marks]

[illegible]

0 6 . 2 A forest is an ecosystem with many trees.

Describe how

- biotic factors
- abiotic factors

affect the growth of **plants** in a forest.

[6 marks]

Question 6 continues on the next page

Turn over ►



0 6 . 3

The bush baby (*Paragalago granti*) and the brown mouse lemur (*Microcebus rufus*) are two species of small mammal that live in tropical forests.

Figure 14 shows a bush baby and a brown mouse lemur.

Figure 14



Bush baby



Brown mouse lemur

The bush baby lives in the forests of eastern Africa. The brown mouse lemur lives in forests on the island of Madagascar.



Describe how the bush baby and the brown mouse lemur could have evolved from a common ancestor.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

20

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



[illegible]

[illegible]

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

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.oxfordaqa.com

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

Copyright © 2026 OxfordAQA International Examinations and its licensors. All rights reserved.



2 8



2 6 1 X B L 0 5

IB/H/Jan26/BL05