

Pearson International Advanced Level

Wednesday 20 May 2026

Afternoon (Time: 1 hour 20 minutes)

Paper

reference

WBI13/01A

Biology

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Biology I

Question Paper

You must have:

Answer Book (sent separately).

Scientific calculator, ruler, HB pencil.

Turn over ►

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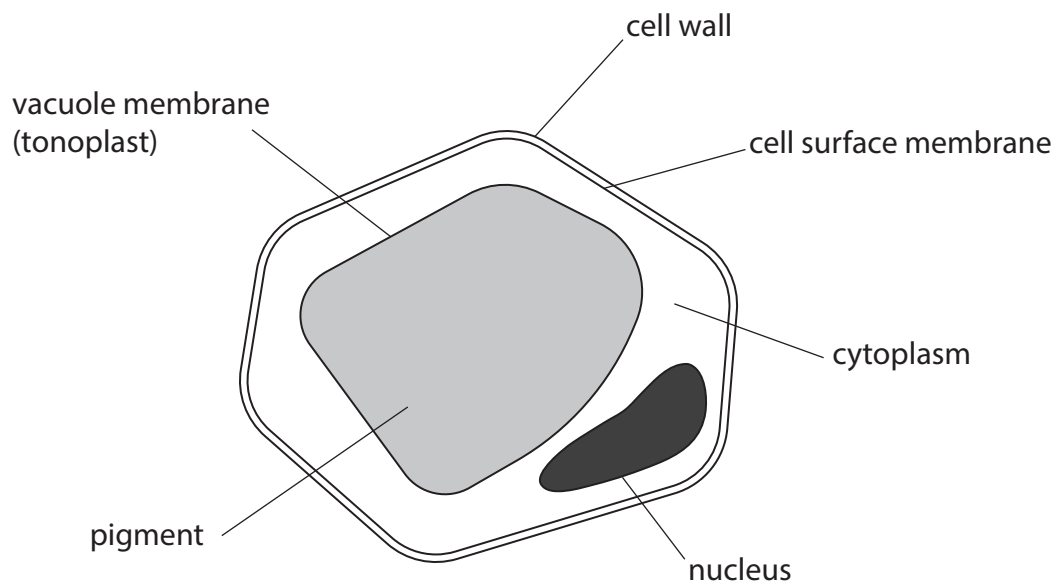

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Answer ALL questions. Write your answers in the Answer Book.

- 1** Cell membranes control the movement of molecules in and out of the cell.

Two molecules that affect the properties of cell membranes are filipin and gramicidin.

The diagram shows an ube (purple yam) cell containing a purple pigment in a vacuole.



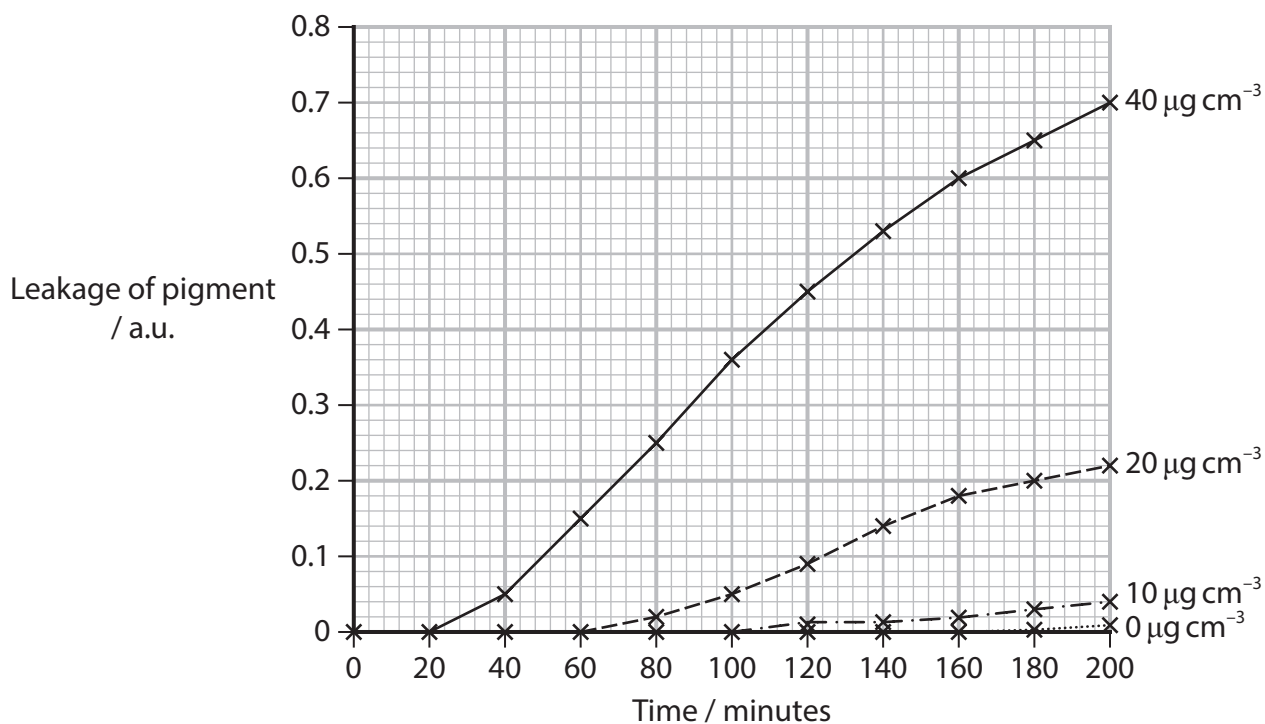
The effect of filipin on ube tissue was investigated.

Different concentrations of filipin were added to ube tissue.

The concentrations used ranged from 0 to $40 \mu\text{g cm}^{-3}$.

The leakage of the pigment was measured every 20 minutes for 200 minutes, at each concentration.

The results are shown in the graph.

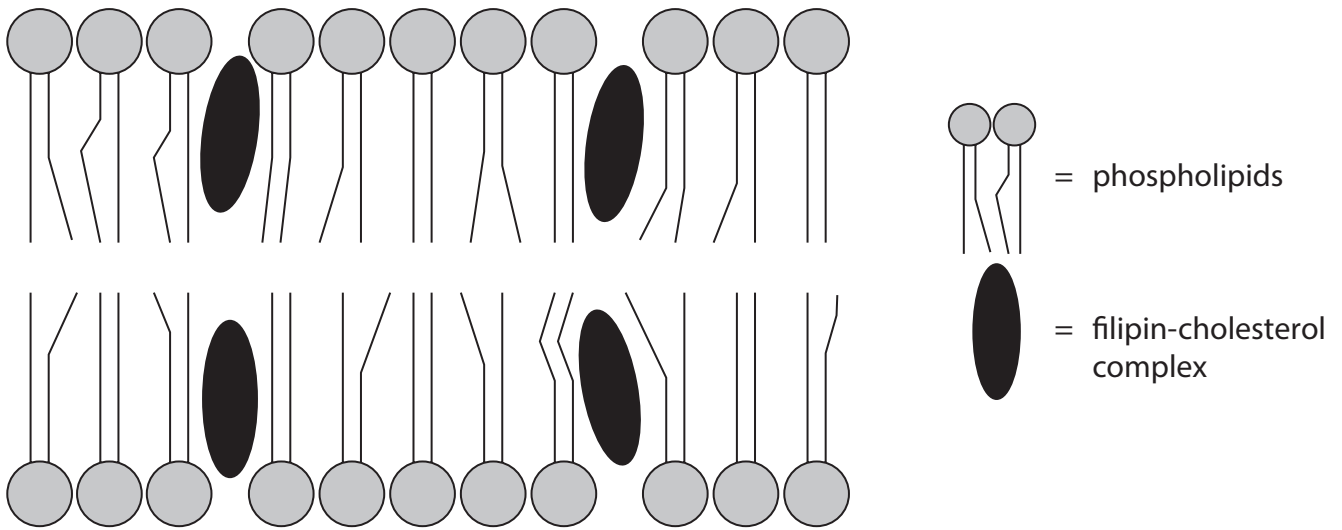


- 1 (a) Suggest why there was no leakage of pigment in the first 20 minutes. (2)
- 1 (b) (i) Describe how the data shown in the graph could have been obtained. (4)
- 1 (b) (ii) Plot a graph in the Answer Book to show the effect of filipin concentration on leakage of pigment at 200 minutes.
Join the points with straight lines. (4)

1 (b)(iii) Filipin binds with cholesterol to form filipin-cholesterol complexes.

These produce gaps in the membrane.

The diagram shows filipin-cholesterol complexes in a membrane.



Comment on the effect of filipin concentrations on the leakage of pigment.

Use the information in the graph and the diagram to help you.

(4)

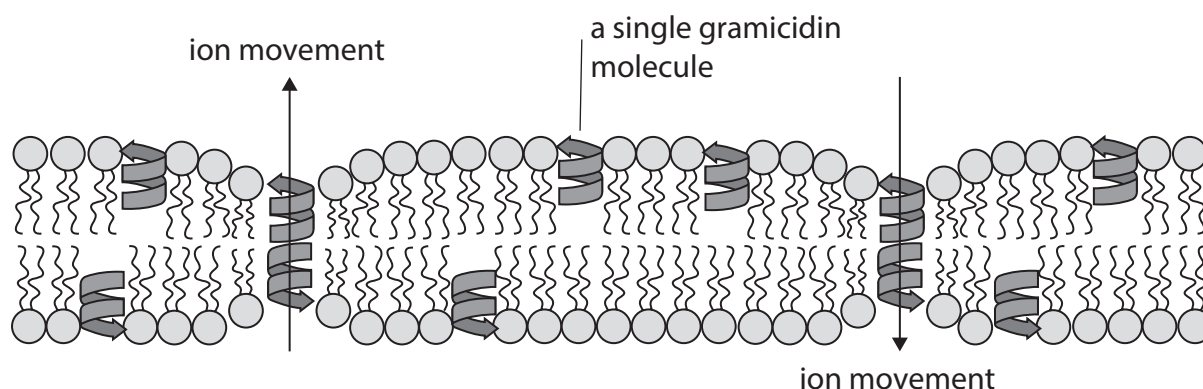
- 1 (c) In an investigation, gramicidin was added to a phospholipid bilayer.

Gramicidin molecules are hollow tubes.

The gramicidin molecules move freely within the bilayer.

Two molecules can move to fit together, forming a hollow channel through the bilayer.

The diagram shows gramicidin molecules in a bilayer and the movement of ions through these channels.

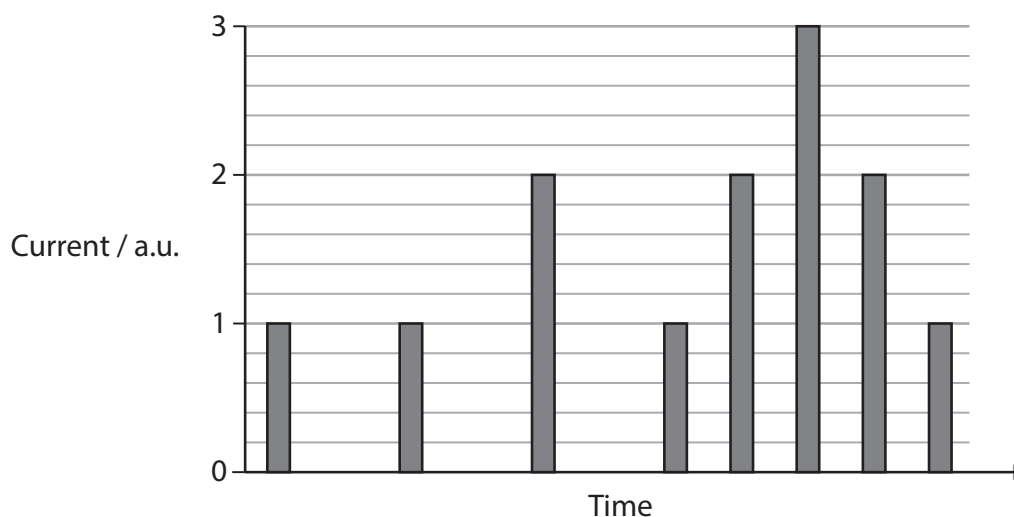


The bilayer was surrounded by a solution containing ions.

A voltage was applied and the current across a part of the phospholipid bilayer was measured over time.

A current flows when the ions move across the bilayer.

The graph shows some results from this investigation.



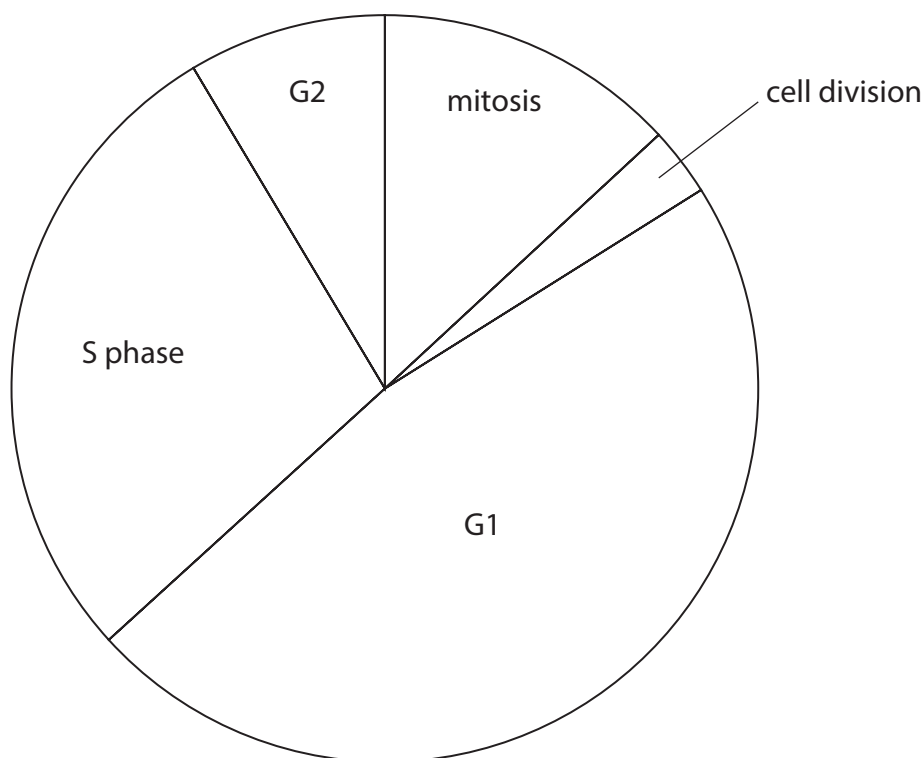
A current of 1 a.u. represents the movement of one ion across the bilayer.

Explain how the movement of gramicidin molecules within the bilayer results in changes in current shown in this diagram.

(3)

(Total for Question 1 = 17 marks)

2 The diagram shows the stages of the cell cycle.



2 (a) (i) Estimate the length of time spent in mitosis during a cell cycle that takes 24 hours.

(1)

2 (a) (ii) Describe what happens during **cell division** in a root tip cell.

(2)

2 (a) (iii) The photographs show the appearance of onion cells during mitosis.

Give the sequence, using the letters, in which these occur in mitosis.



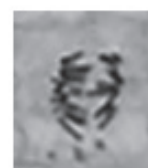
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(1)

- 2 (b) The flowchart shows the procedure that was used to observe the stages of mitosis in the cells of onion root tips.

Step 1. A root tip was removed from an onion that had been growing in water



Step 2. The root tip was placed in hydrochloric acid



Step 3. The root tip was rinsed in water and a stain was applied



Step 4. The stained root tip was placed on a microscope slide



Step 5. A cover slip was placed over the stained root tip

Justify each of these steps.

(5)

- 2 (c) Aflatoxins are produced by some fungi.

Aflatoxins can cause uncontrolled cell division.

The effect of one aflatoxin on mitosis in root tips of onion was investigated.

Root tips were treated with a range of concentrations of aflatoxin.

The mitotic index in each treated sample was compared with a control sample by calculating the Relative Division Rate (RDR).

$$\text{RDR} = \frac{\text{mitotic index in treated sample}}{\text{mitotic index in control sample}} \times 100 (\%)$$

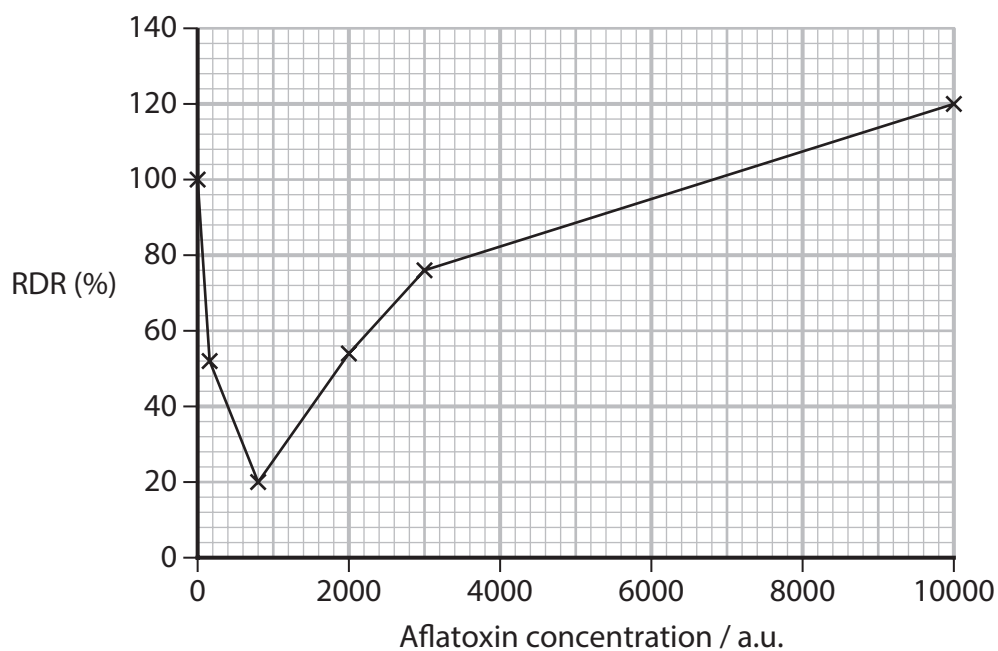
An RDR of 100% indicates that there are as many cells undergoing mitosis in the treated sample as in the control sample.

- 2 (c) (i) State the dependent variable in this investigation. (1)

- 2 (c) (ii) Give **two abiotic** variables that need to be controlled when the onion roots are growing and suggest how they can be controlled. (4)



2 (c) (iii) Some results are shown in the graph.



Draw a table in the Answer Book to show all the results in the graph.

(3)

2 (c) (iv) Aflatoxins cause uncontrolled cell division in humans.

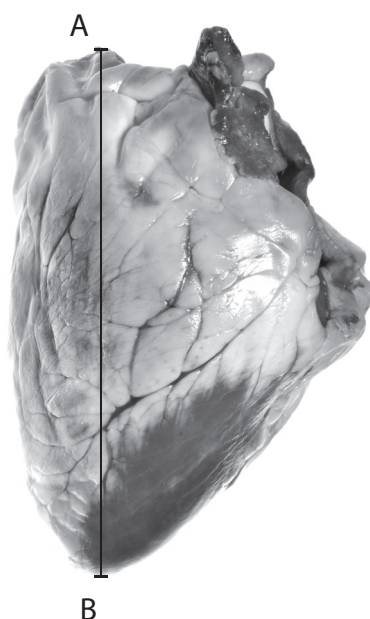
Comment on the extent to which the results shown in the graph support this statement.

(3)

(Total for Question 2 = 20 marks)

3 The photograph shows a mammalian heart.

It is orientated as it would be in the body of an animal facing you.



(Source: © PjrStudio/Alamy)

magnification $\times 0.78$

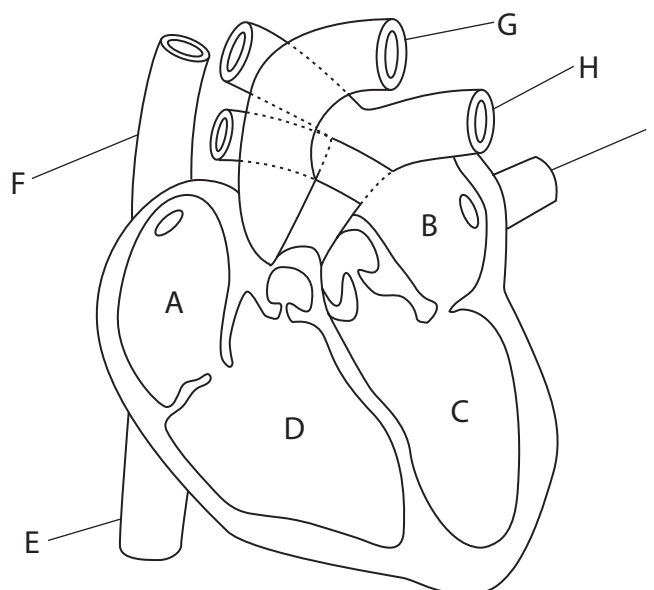
3 (a) The length between A and B on the photograph is 7 cm.

Calculate the actual length of this heart from A to B.

Give your answer to **two** significant figures.

(2)

3 (b) The diagram shows a mammalian heart in section.



3 (b) (i) Give the letter of the blood vessel that carries blood from the legs to the heart.

(1)

3 (b) (ii) Give the sequence of letters that describes the flow of blood into the left ventricle and then out to the body.

(2)

3 (c) The photographs show echocardiograms of part of two hearts.

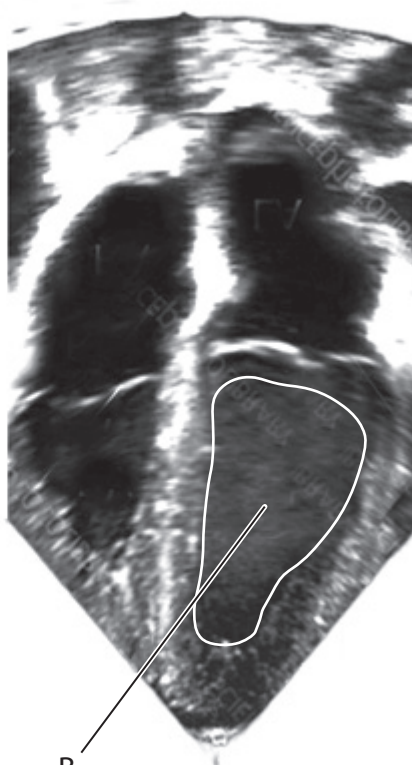
One heart is normal and the other heart has an enlarged ventricle.

In each echocardiogram the circumference of the left ventricle is shown.



A

Normal



B

With enlarged ventricle

Calculate the percentage increase in the length of ventricle B compared with ventricle A.

(2)

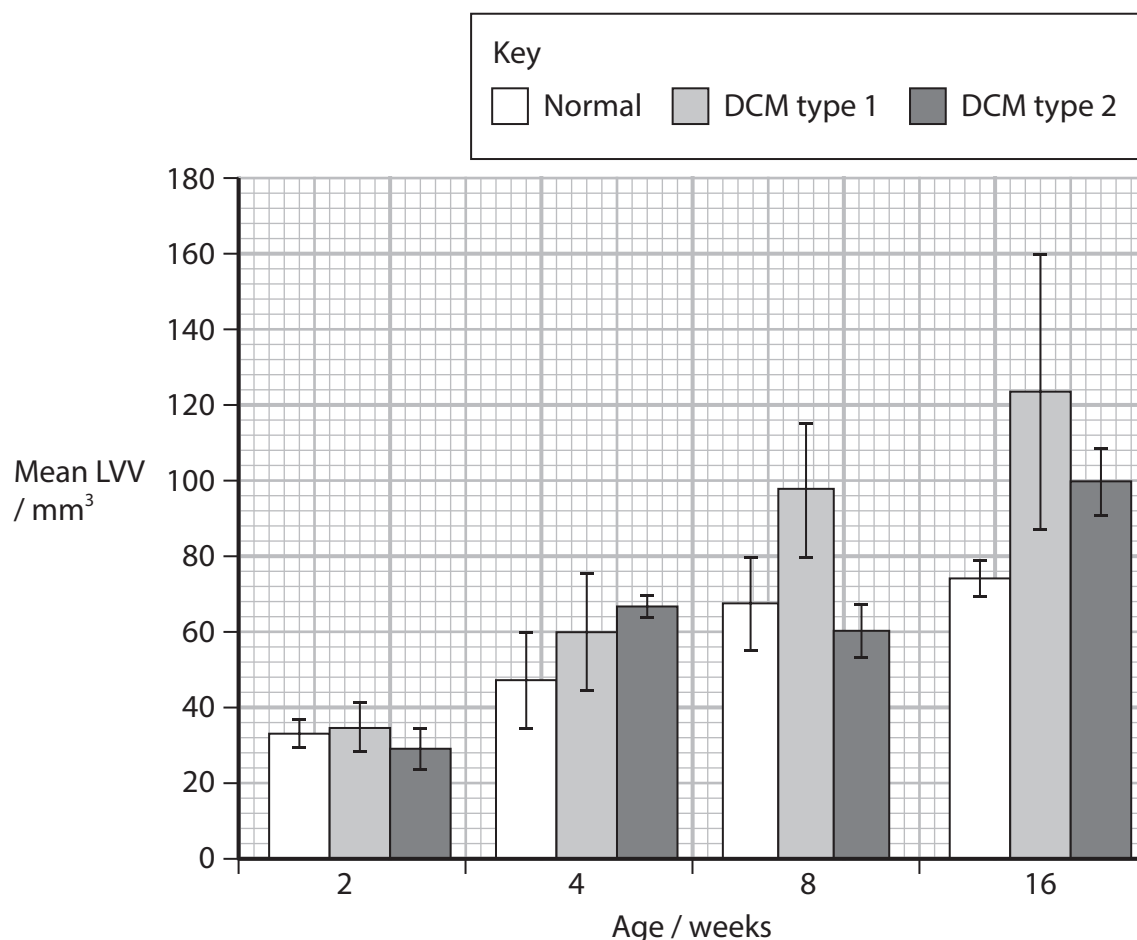
- 3 (d) Inherited dilated cardiomyopathy (DCM) is a genetic condition in which the left ventricle of the heart becomes enlarged and weakened.

There are two types of DCM, type 1 and type 2.

The left ventricular volumes (LVV) in groups of mice with normal, type 1 DCM and type 2 DCM hearts were measured.

Measurements were made when the mice were 2, 4, 8 and 16 weeks old.

The graph shows the results.



- 3 (d) (i) Calculate the ratio of the mean LVV for normal, type 1 and type 2 DCM hearts at 8 weeks.

Express your answer as normal : type 1 : type 2 DCM.

(2)

- 3 (d) (ii) Describe the effect of the two types of DCM on the LVV during the development of mice, using these results.

(4)

(Total for Question 3 = 13 marks)

TOTAL FOR PAPER = 50 MARKS

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	

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Answer Book

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Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Write your answers in the spaces provided.

1 (a)

(2)

1 (b) (i)

(4)

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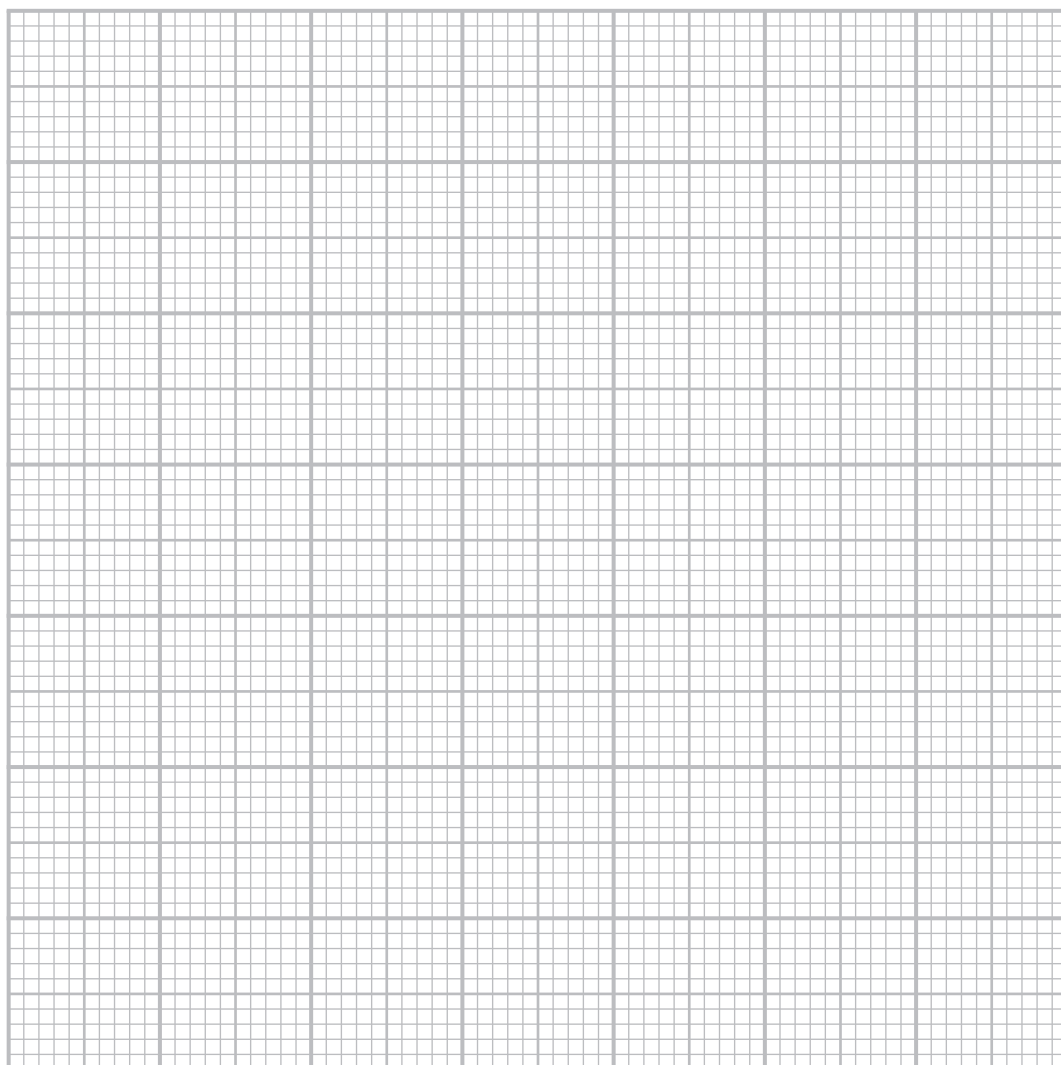
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1 (b) (ii)

(4)



1 (b)(iii)

(4)

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1 (c)

(3)

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(Total for Question 1 = 17 marks)



2 (a) (i)

(1)

Answer

2 (a) (ii)

(2)

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2 (a) (iii)

(1)

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2 (b)

(5)

Step 1

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Step 2

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Step 3

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Step 4

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Step 5

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2 (c) (i)

(1)

2 (c) (ii)

(4)

Variable

How controlled

Variable

How controlled



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2 (c) (iii)

(3)

2 (c) (iv)

(3)

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(Total for Question 2 = 20 marks)



3 (a)

(2)

Answer

3 (b) (i)

(1)

3 (b) (ii)

(2)

3 (c)

(2)

Answer



3 (d) (i)

(2)

Answer:1

3 (d) (ii)

(4)

(Total for Question 3 = 13 marks)

TOTAL FOR PAPER = 50 MARKS



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