Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9042809475

BIOLOGY **5090/42**

Paper 4 Alternative to Practical **October/November 2023**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

DC (DE/CB) 314021/4

1 Some animals that live in cold climates need to reduce the loss of heat from their bodies.

A student investigated the effect of using an insulating material on heat loss from an animal. They used a test-tube to represent the animal and some wool, which is known to be a good insulator.

They marked a line on the test-tube 2 cm below the top.

They placed the wool in a beaker and inserted the test-tube so that it was completely surrounded by wool as shown in Fig. 1.1.

A second marked test-tube was placed in a test-tube rack as shown in Fig. 1.1. This had no insulation.

Hot water was added up to the lines drawn on both test-tubes.

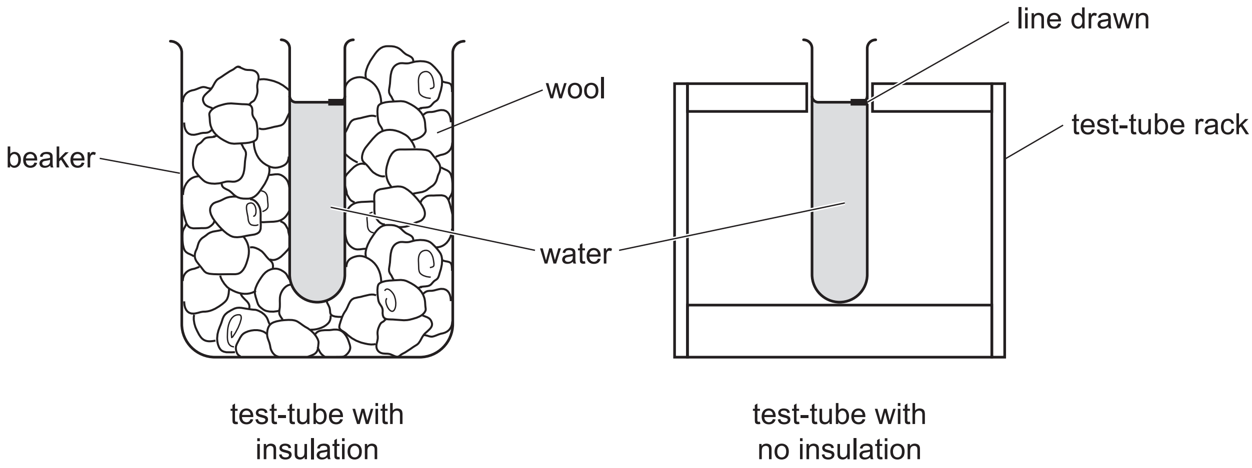


Fig. 1.1

Immediately, a timer was started and the temperature of the water in both test-tubes was measured.

(a) Suggest why both test-tubes were filled with water only up to the marked line.

....

.... [1]

(b) In a notebook, the student recorded the temperature of the water in each test-tube every two minutes for ten minutes as shown.

Time:	*2*	*4*	*6*	*8*	*10*
No insulation:	*66.5*	*60.5*	*55.5*	*52*	*49*
With insulation:	*73*	*69.5*	*66*	*63*	*61.5*

Fig. 1.2 shows the thermometer readings at 12 minutes.

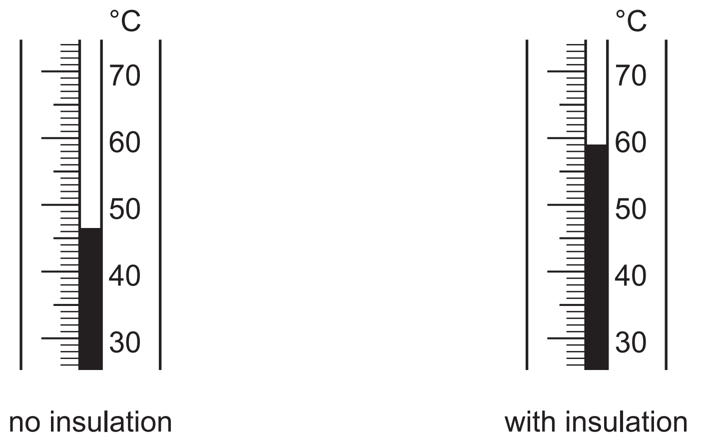


Fig. 1.2

(i) Enter all the data for the temperatures in Table 1.1.

Table 1.1

time / minutes	water temperature / °C	
	test-tube with insulation	test-tube with no insulation
0	76.5	75.0
2		
4		
6		
8		
10		
12		

[4]

(ii) Use the results in Table 1.1 to describe the loss of heat from the test-tubes and the effect of the insulation.

....

....

....

....

....

.... [3]

(c) Humpback whales are large aquatic mammals that maintain a constant body temperature of 38 °C. They spend part of the year in cold polar water and part of the year in warm equatorial water.

Design an investigation that you could carry out to discover the effect of different surrounding water temperatures on the loss of heat by the humpback whale. Use a test-tube filled with water to represent the humpback whale.

....

....

....

....

....

....

....

....

....

....

....

.... [6]

[Total: 14]

BLANK PAGE

2 A pulse oximeter is a device that fits on the end of a finger. It measures the heart rate (pulse rate) in beats per minute and the percentage of oxygen in the blood (%SpO2).

Fig. 2.1 shows a photograph of a pulse oximeter.

Fig. 2.1

A student used a pulse oximeter to investigate the effect of exercise on heart rate and the percentage of oxygen in the blood.

The student recorded three readings from the pulse oximeter before exercise (0, 1 and 2 minutes). They then exercised for five minutes. At the end of five minutes they recorded four readings at one minute intervals (7, 8, 9 and 10 minutes).

Some of the results are shown in Table 2.1.

Table 2.1

time / minutes	heart rate / beats per minute	percentage blood oxygen
0	65	99
1		
2	66	99
7	110	98
8	96	99
9	85	98
10	66	99

The photograph in Fig. 2.1 shows the pulse oximeter readings at 1 minute.

(a) **(i)** Record readings for 1 minute in Table 2.1. [1]

(ii) On the grid below construct a line graph of the **heart rate** against time. Join the points with ruled straight lines.

[4]

(iii) Identify the period of exercise on your graph by drawing **two** lines.

- Draw one beginning from the point at which exercise started and finishing at the axis. Label this line **S**.
- Draw one beginning from the point at which exercise ended and finishing at the axis. Label this line **E**.

[2]

(iv) Suggest why it would **not** be valid to use the graph to determine the heart rate at 5 minutes.

....

....

....

.... [2]

(b) **(i)** Describe any changes in heart rate and the percentage of oxygen in the blood during the investigation, using the data in your graph and Table 2.1.

heart rate ....

....

....

....

percentage oxygen ....

....

....
[3]

(ii) The student thought that changes in their breathing could have affected the percentage of oxygen in their blood during exercise. Suggest **two** changes in breathing that could be measured to help explain the percentage oxygen levels during the investigation.

1 ....

2 ....
[2]

[Total: 14]

3 When a seed germinates, the radicle emerges to start developing into the root. A student decided to investigate the growth of the radicle as a seed germinated.

The student used a seed that had been germinating for a few days. Eight equally spaced lines were marked on the radicle as shown in Fig. 3.1.

The seed was then placed in suitable conditions in the dark with the radicle pointing vertically downwards. Two days later, the radicle had grown as shown in Fig. 3.1.

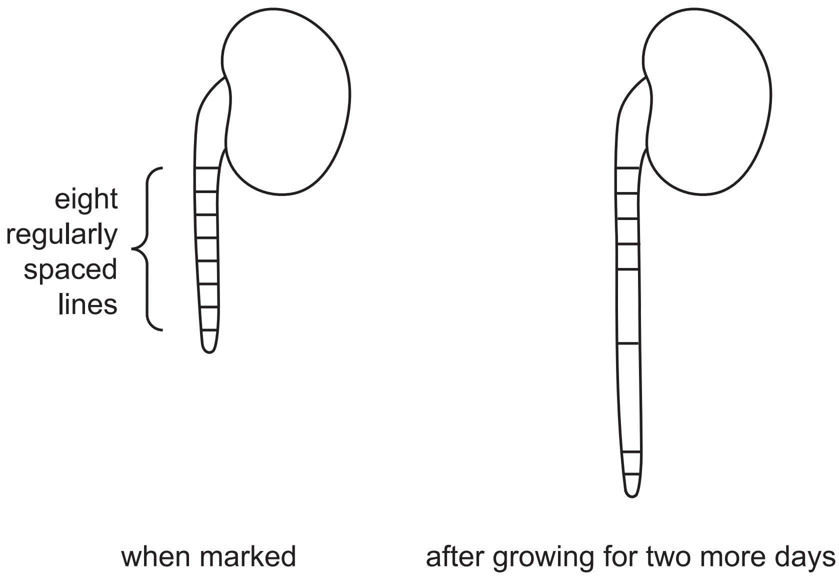


Fig. 3.1

(a) **(i)** Describe the observable changes that occurred in the two days after marking the radicle.

....

....

....

.... [2]

(ii) Suggest why the student placed the seed with the radicle pointing vertically downwards instead of horizontally.

....

.... [1]

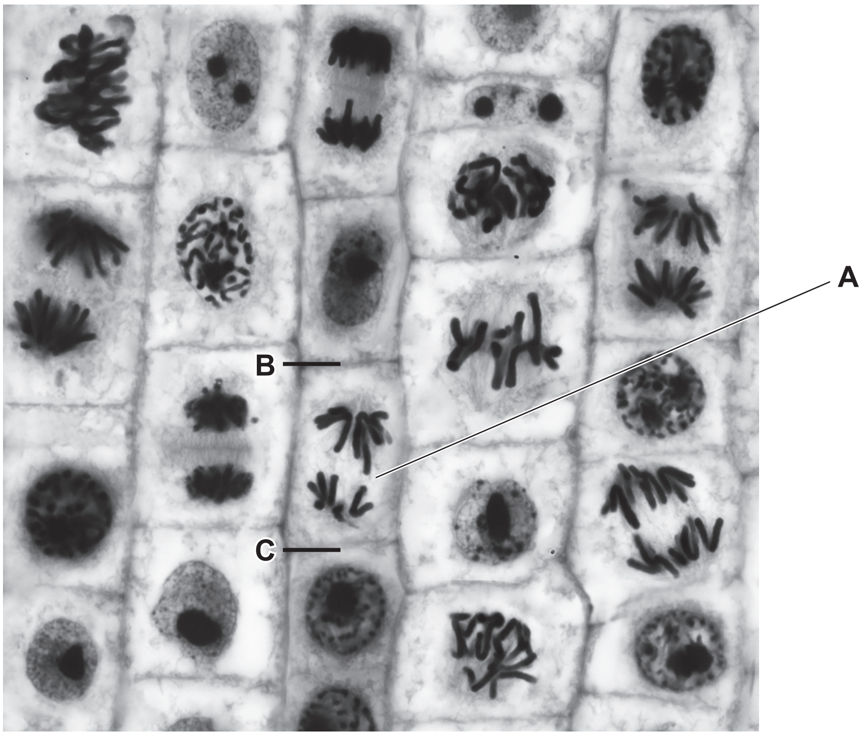
(iii) State **two** environmental conditions, other than light, that the student could control to ensure maximum growth of the radicle.

1 ....

2 ....

[2]

(b) The student examined a section of a root tip under the microscope and saw cells undergoing mitosis as shown in the photomicrograph in Fig. 3.2.



magnification ×600

Fig. 3.2

(i) In the space below make a large drawing of the cell labelled **A** as it appears in the photomicrograph in Fig. 3.2.

[4]

(ii) Lines **B** and **C** indicate the length of cell **A**. Draw a straight line **on the photomicrograph** to join **B** and **C**. Measure the length of this line and record it.

....

Calculate the actual length of the cell and record it to the nearest two decimal places.

Space for working.

.... mm [3]

[Total: 12]

BLANK PAGE