Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

6318160821

BIOLOGY **5090/41**

Paper 4 Alternative to Practical **May/June 2024**

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.

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1 Respiration which releases energy from food in living organisms can be summarised by the following equation:

glucose + oxygen → carbon dioxide + water

A student investigated the rate at which oxygen was used for respiration by some small animals. The apparatus shown in Fig. 1.1 was used.

The apparatus was sealed by closing the clip so that any changes in the volume of gases in the test-tube and capillary tube resulted in the drop of coloured liquid moving.

The rate at which the drop of coloured liquid moves is related to the rate of uptake of oxygen by the small animals.

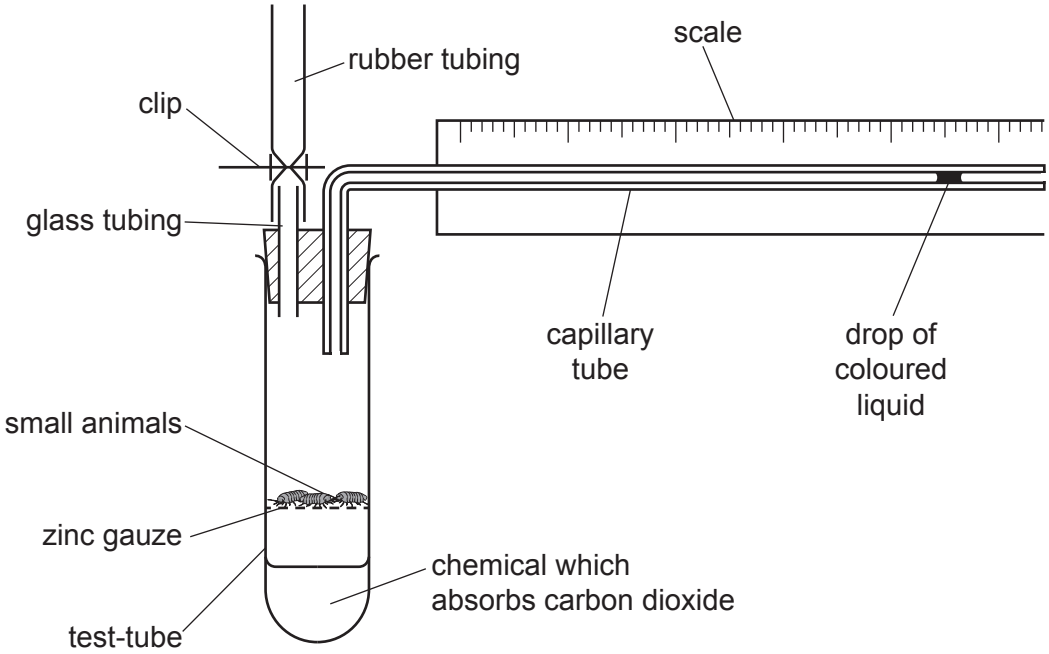


Fig. 1.1

When the small animals in the test-tube respire they take in oxygen and produce carbon dioxide.

(a) **(i)** Describe what happens to the carbon dioxide they produce.

.....

..... [1]

(ii) Explain why the drop of coloured liquid moves along the capillary tube towards the small animals.

.....

.....

.....

..... [2]

(b) At the start of the investigation the student read and recorded the starting position of the drop of coloured liquid against the scale. Then readings were taken every 10 minutes for 40 minutes. All readings were taken at the **left side** of the drop.

Fig. 1.2 shows the position of the drop at the start and after 40 minutes.

(i) Complete Table 1.1 by inserting these readings.

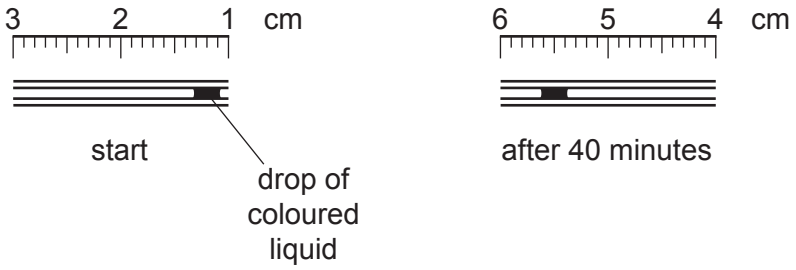


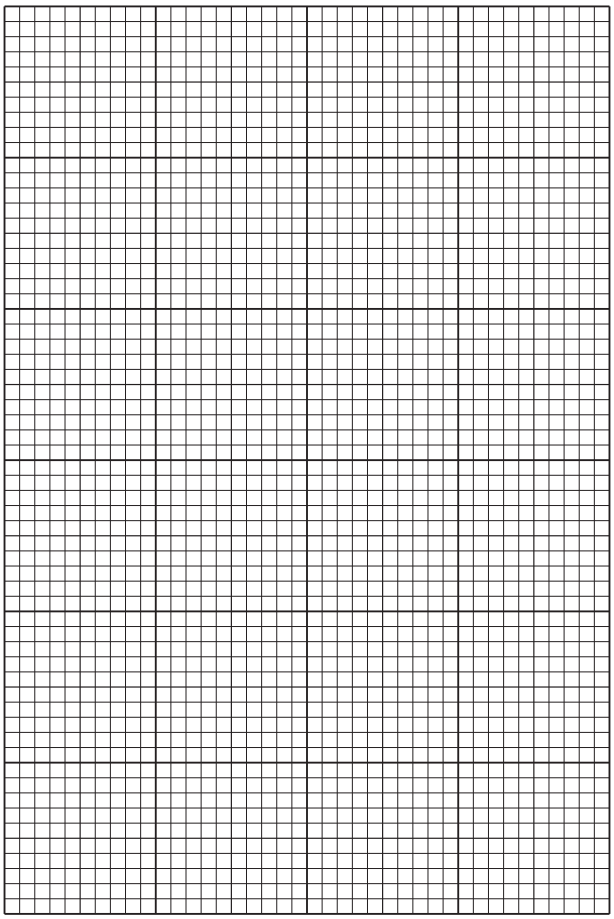
Fig. 1.2

Table 1.1

time / minutes	position of drop / cm
0	
10	2.5
20	3.9
30	4.2
40	

[2]

(ii) Construct a graph of the data in the completed Table 1.1 on the grid below. Join your plotted points with ruled, straight lines. [4]



(iii) Use your graph to estimate the position of the drop at 25 minutes.

Show your working on the graph.

position of drop at 25 minutes ..... [3]

(c) **(i)** Calculate the distance moved by the drop during the investigation.

..... cm [1]

(ii) Calculate the rate of movement of the drop during the investigation in cm per minute.

Show your working.

rate of movement of drop ..... cm per minute [2]

(d) **(i)** Suggest why the student should repeat this investigation several times.

.....

.....

.....

..... [2]

(ii) Suggest a control experiment for this investigation.

.....

.....

..... [1]

[Total: 18]

2 **(a)** **(i)** Fig. 2.1 shows four arthropods.

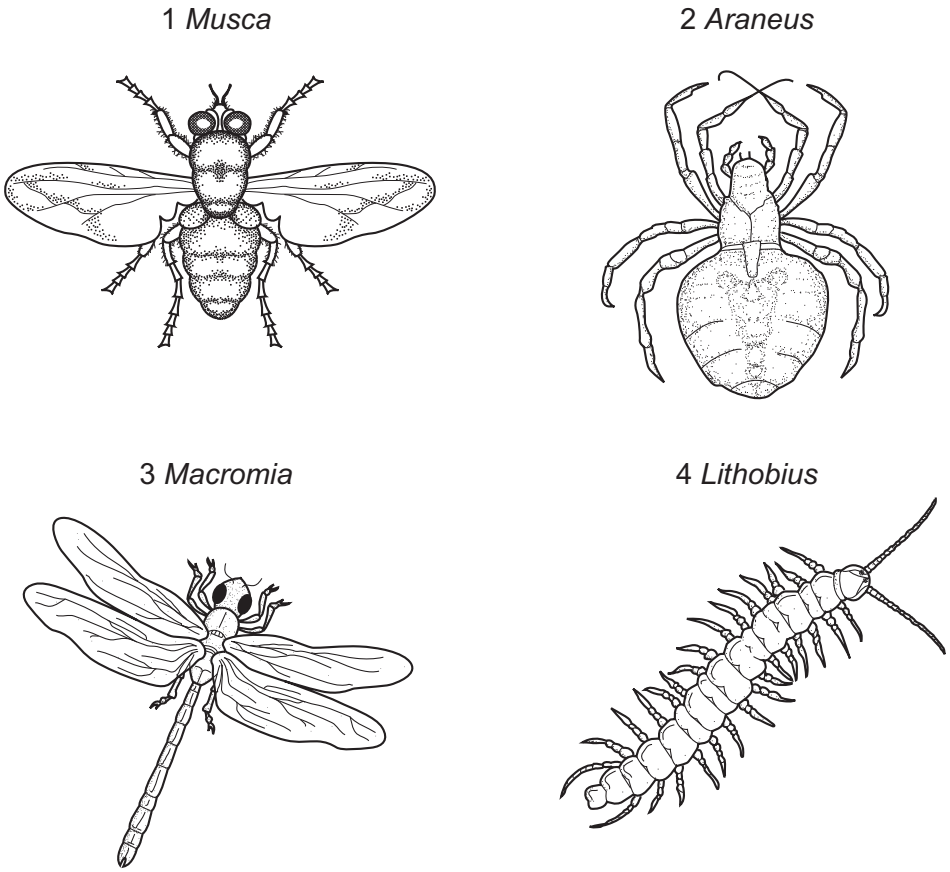


Fig. 2.1

Use the key to identify each arthropod. Complete the key by writing one genus name in each of the four boxes. [3]

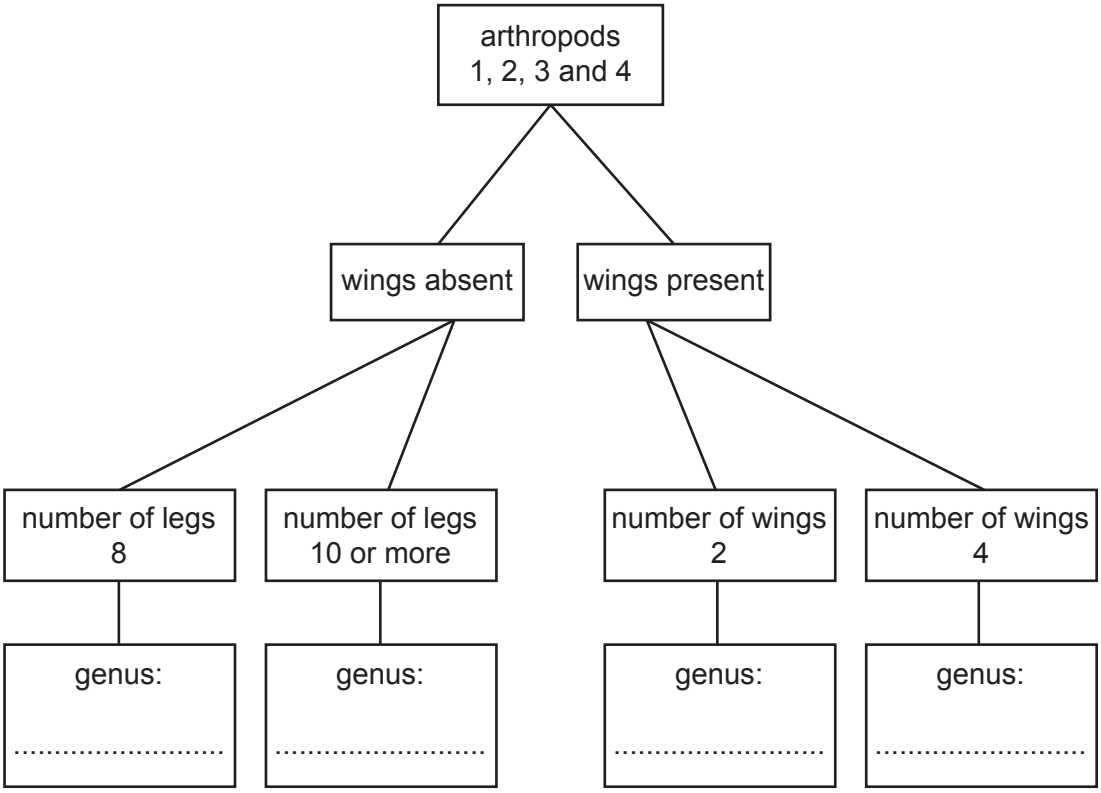


Fig. 2.2

(ii) Describe a difference in **one other** feature, not used in the key, to distinguish between *Araneus* and *Lithobius*.

Araneus .....

.....

Lithobius .....

..... [1]

(b) Fig. 2.3 is a photograph of an immature arthropod that lives in water.

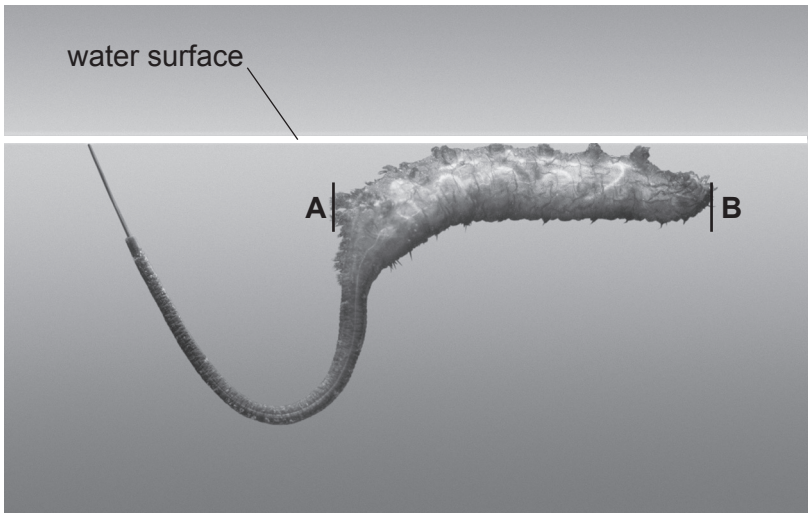


Fig. 2.3

(i) In the space below make a large drawing of the immature arthropod as it appears in the photograph. [5]

(ii) Draw a straight line to join **A** and **B** on the photograph in Fig. 2.3. This is the length of the body of the arthropod as it appears in the photograph. Measure and record this length.

..... [1]

(iii) The length of the body of the **actual** arthropod is 16 mm. Use this value to calculate the magnification of the photograph to 1 decimal place.

Space for working.

..... [1]

[Total: 11]

3 **(a)** A student investigated the effect of exercise on their heart rate.

The student measured their heart rate when resting. They did this by sitting down and counting the number of heartbeats in 15 seconds and then multiplying that to get the number in 60 seconds.

The student then exercised for 10 minutes. After 10 minutes the student stopped exercising and measured their heart rate for the 3 minutes after stopping.

Table 3.1 shows some of their results.

Table 3.1

time after exercise in minutes	heartbeats in 15 seconds	heartbeats per minute
1	33	132
2	26	104
3	22	
	total number of heartbeats in 3 minutes:	

(i) Complete Table 3.1 by inserting the two missing numbers. [2]

The student's heart rate when resting was 68 heartbeats per minute.

(ii) Use this information and the data in the table to describe the changes in the student's heart rate during this investigation.

.....

.....

.....

..... [2]

(b) The time it takes for the heart rate to return to its normal resting rate after exercise depends on the person's fitness. A fit person's heart rate returns to normal in a shorter time.

(i) Plan an investigation to determine which of two athletes is the fittest.

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..... [6]

(ii) State the dependent variable in your investigation.

..... [1]

[Total: 11]

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