Cambridge Assessment International Education

# Cambridge IGCSE™

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**BIOLOGY** **0610/61**

Paper 6 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 **16** pages. Any blank pages are indicated.

DC (LK/SG) 317075/3


**[Turn over**

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**1** Emperor penguins are large birds found in Antarctica where temperatures can be very low.

Fairy penguins are small birds that live in Australasia where temperatures are much warmer.

The body temperature of both species of penguin is maintained at approximately 38°C.

A student investigated the rate of heat loss from a penguin with a large body compared with a penguin with a small body.

They used a 250 $cm^3$ beaker to represent the emperor penguin and a large test-tube to represent the fairy penguin.

The student used this method:

Step 1 Label the beaker **A** and the test-tube **B**.

Step 2 Draw a line on beaker **A** and test-tube **B** 5 cm up from the bottom.

Step 3 Use hot water to fill beaker **A** up to the 5 cm mark.

Step 4 Place a thermometer in the water in beaker **A**.

When the reading on the thermometer has stopped rising, measure the temperature of the water. Record this as the starting temperature.

Leave the thermometer in the water throughout the investigation.

Step 5 Start the stop-clock.

Step 6 After one minute, measure and record the temperature of the water in beaker **A**.

Step 7 Measure and record the temperature of the water in beaker **A** every minute for a total of five minutes.

Step 8 Add hot water to test-tube **B** up to the 5 cm mark.

Step 9 Repeat steps **4** to **7** using test-tube **B** instead of beaker **A**.

Fig. 1.1 shows the notes the student made about the results for the first four minutes.

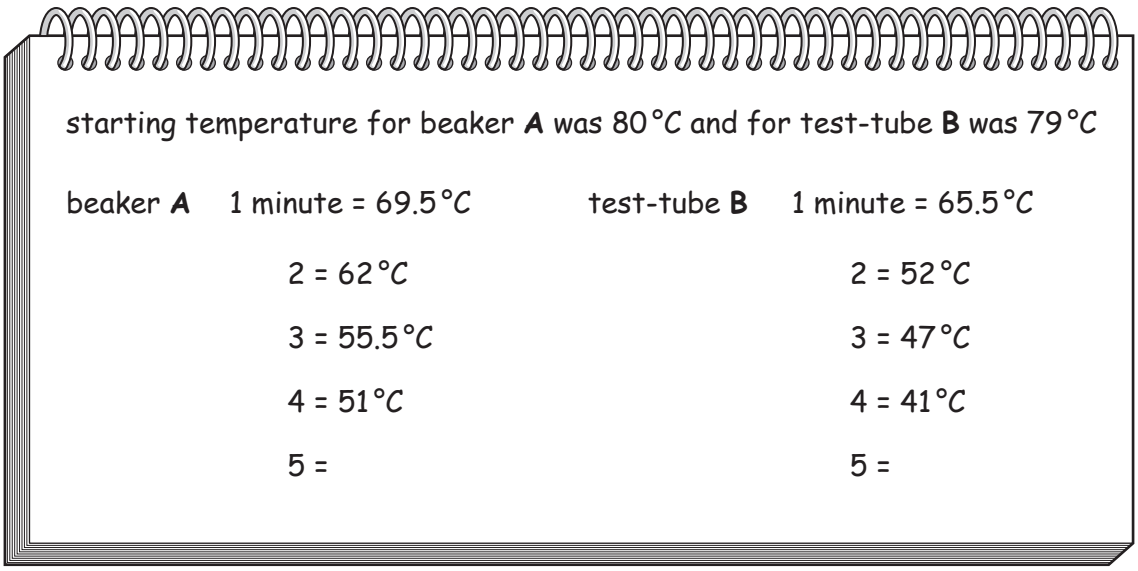


**Fig. 1.1**

Fig. 1.2 shows the thermometers for beaker **A** and test-tube **B** at five minutes.

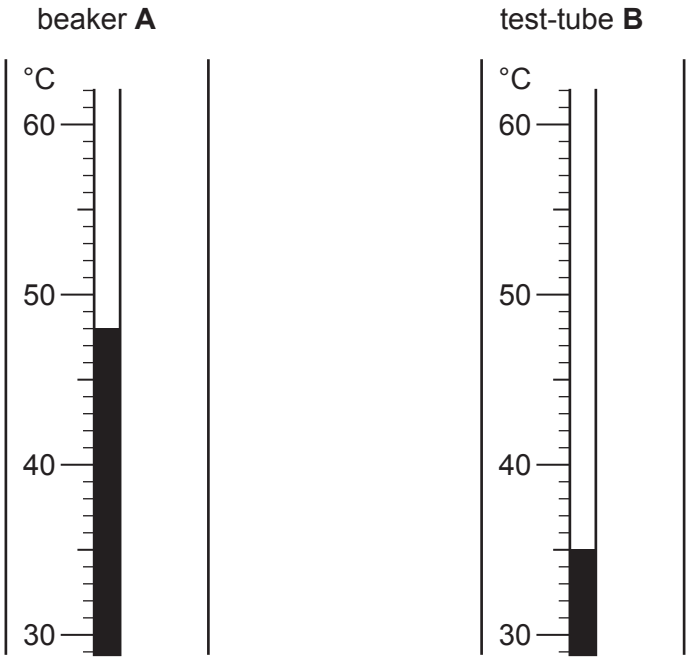


**Fig. 1.2**

**(a) (i)** Prepare a table and record the results shown in Fig. 1.1 and Fig. 1.2 to an appropriate number of decimal places.

[4]

**(ii)** The rate of heat loss can be calculated using the equation:

$$\text{rate of heat loss} = \frac{\text{change in temperature}}{\text{time}}$$

Using the results, calculate the rate of heat loss in beaker **A** and the rate of heat loss in test-tube **B** during the five minutes of the investigation.

Include the units.

Space for working.

rate of heat loss in beaker **A** .....

rate of heat loss in test-tube **B** .....
[3]

**(iii)** Suggest the effect of penguin body size on the rate of heat loss.

.....

.....

..... [1]

**(b) (i)** Identify the independent variable in this investigation.

..... [1]

**(ii)** Identify **one** variable that should be kept constant in this investigation.

..... [1]

**(c) (i)** Cubes of agar jelly can be used as model cells.

Agar jelly cubes are colourless and can be stained pink with an indicator. When placed in an acid solution, the acid diffuses into the agar jelly cubes and the pink colour starts to disappear. When the acid has reached the centre of the agar jelly cube, the agar is completely colourless. This is shown in Fig. 1.3.

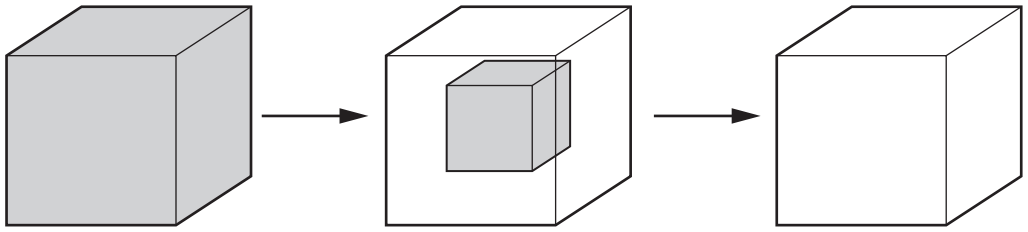


**Fig. 1.3**

Plan an investigation to determine the effect of temperature on the **rate** of diffusion in model cells.

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.....

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..... [6]

**(ii)** The length of a side of a cube of agar jelly is 1 cm.

Calculate the surface area to volume ratio of this cube.

surface area ..... : volume .....
[2]

[Total: 18]

**2** **(a)** Fig. 2.1 is a photograph of a lizard.


magnification ×0.6

**Fig. 2.1**

Line **CD** represents the length of the lizard.

Measure the length of line **CD** on Fig. 2.1.

length of line **CD** ..... mm

Calculate the actual length of the lizard using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line } \mathbf{CD}}{\text{actual length of the lizard}}$$

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

Space for working.

..... mm
[3]

**(b)** Fig. 2.2 is a photomicrograph of lizard blood cells.

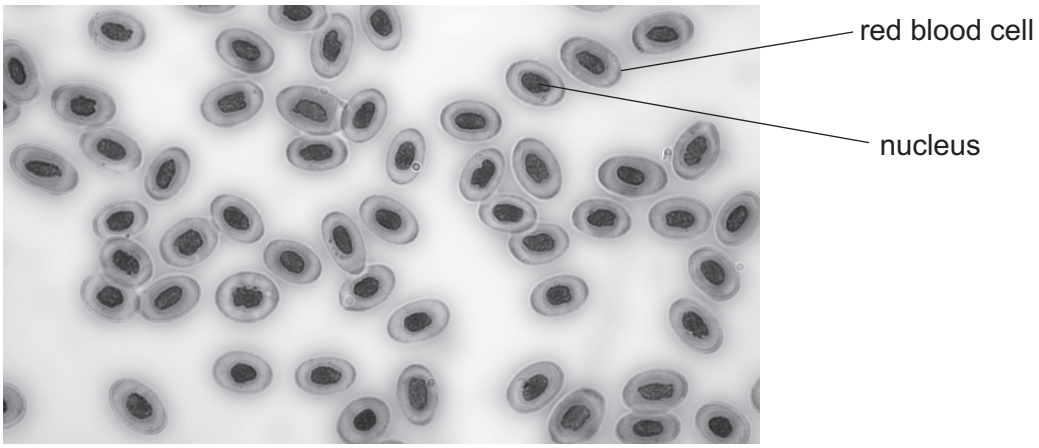



**Fig. 2.2**

Fig. 2.3 is a photomicrograph of human blood cells.

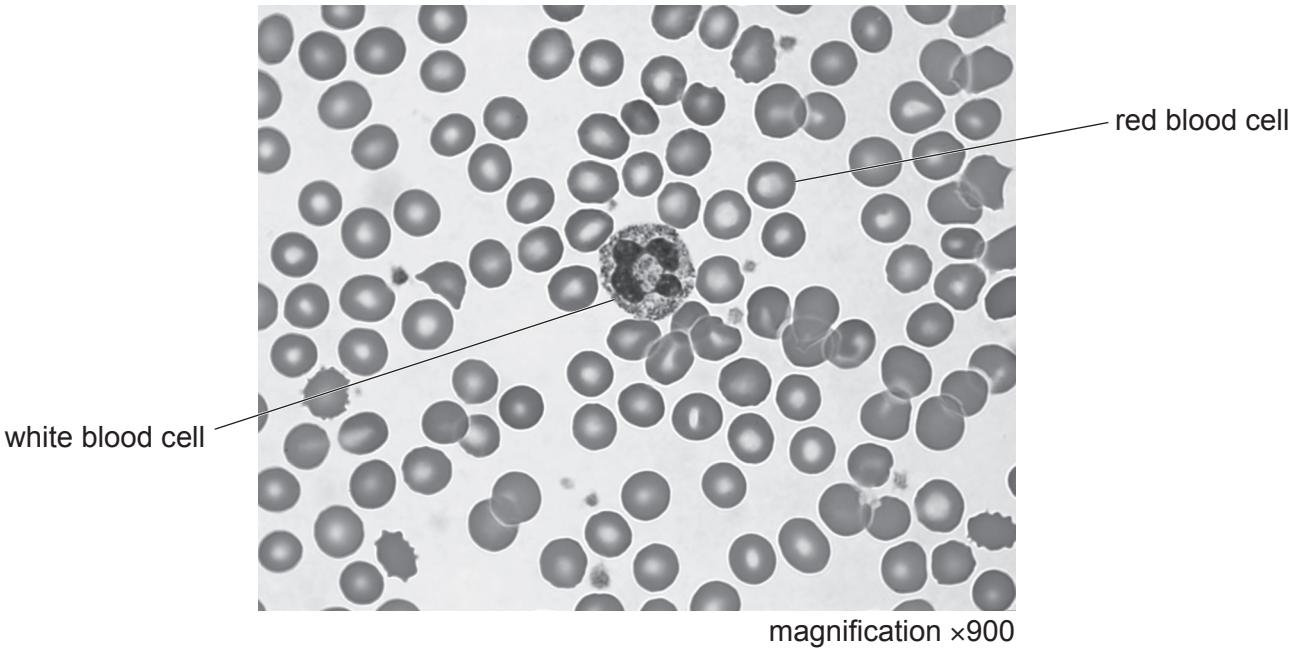



**Fig. 2.3**

**(i)** State **two** ways the lizard blood cells shown in Fig. 2.2 are different from the human blood cells shown in Fig. 2.3.

1 .....

.....

2 .....

.....

[2]

**(ii)** Fig. 2.4 shows one white blood cell.

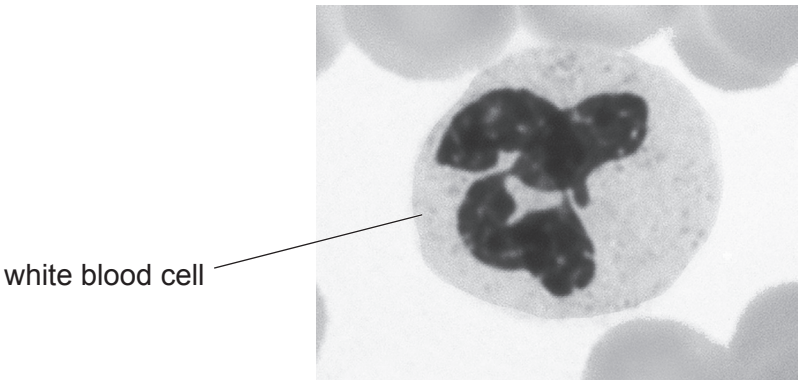



**Fig. 2.4**

Draw a large diagram of the white blood cell shown in Fig. 2.4.

[4]

**(c)** Haemoglobin is a protein found in human red blood cells. Haemoglobin carries oxygen.

Athletes from a low altitude (height above sea level) location train at high altitude in order to temporarily increase their haemoglobin levels.

Scientists studied how long the increase lasted once the athletes returned to the low altitude location.

Table 2.1 shows the results of the study.

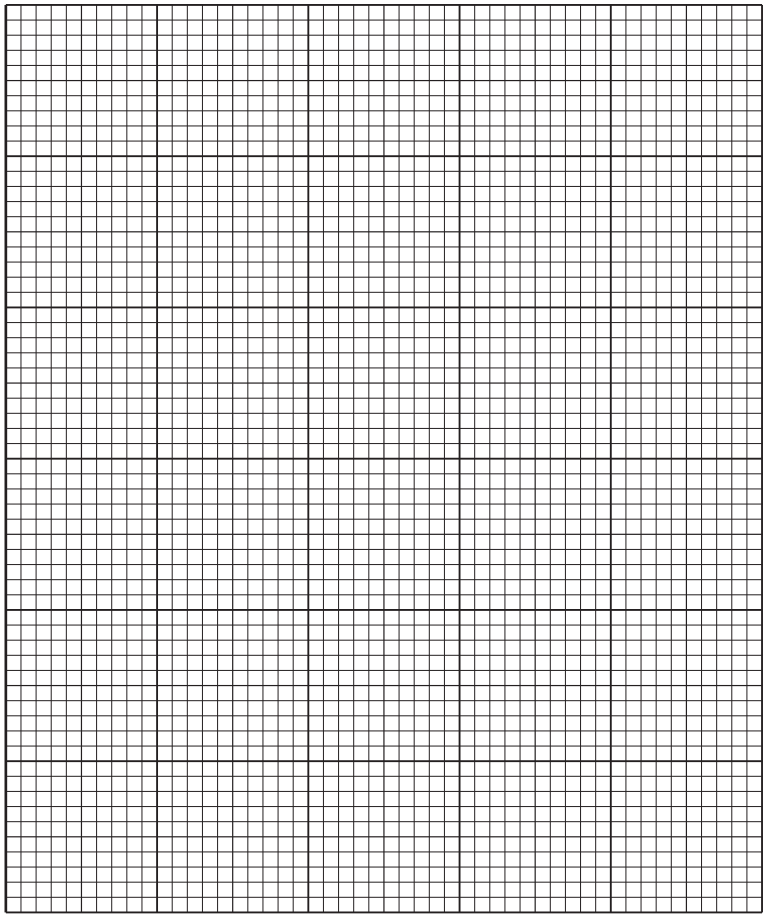
**Table 2.1**

| number of days after returning to low altitude | mean mass of haemoglobin per athlete / g |
|---|---|
| 2 | 650 |
| 7 | 650 |
| 14 | 650 |
| 21 | 630 |
| 28 | 624 |
| 33 | 605 |
| 40 | 604 |

**(i)** Identify the dependent variable in this investigation.

..... [1]

**(ii)** Using the data in Table 2.1, plot a line graph on the grid to show the effect of returning to low altitude on the mean mass of haemoglobin per athlete.



[4]

**(iii)** Use your graph to estimate the mean mass of haemoglobin per athlete 17 days after returning to low altitude.

Indicate on your graph how you obtained your estimate.

..... g
[2]

**(d)** Scientists investigated the effect of different amounts of carbohydrate in the diet on the length of time an athlete can continue to exercise until exhausted.

The results of the investigation are shown in Fig. 2.5.

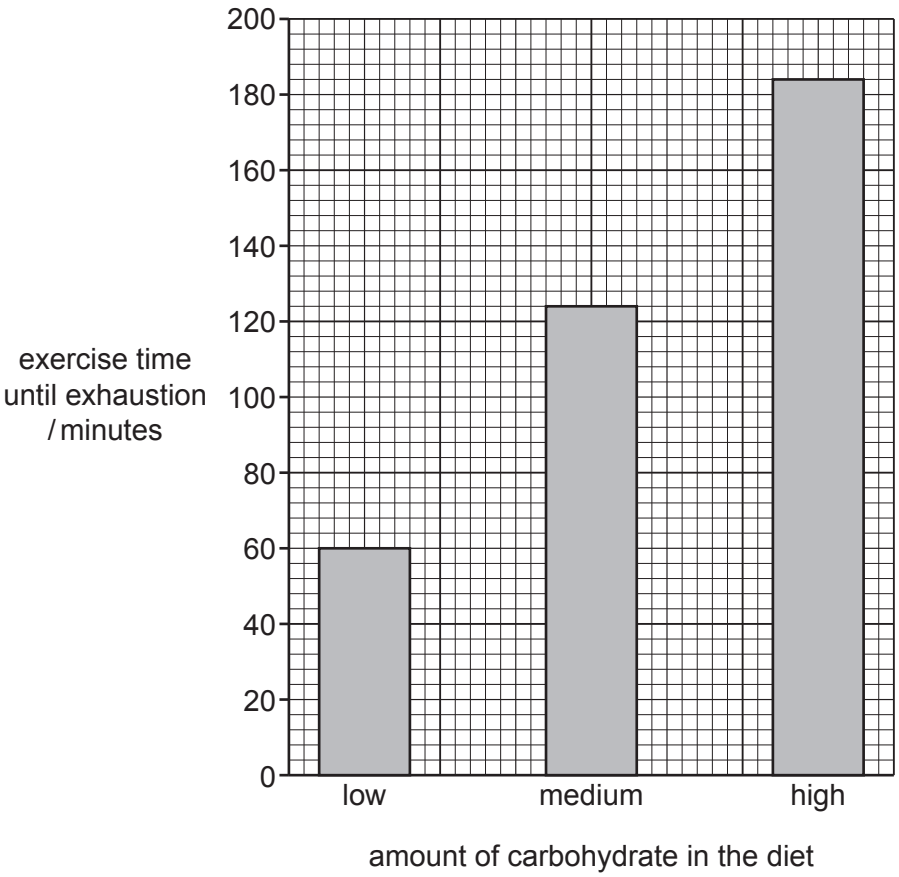



**Fig. 2.5**

**(i)** State a conclusion for this investigation.

.....

.....

..... [1]

**(ii)** The scientists carefully selected athletes for the three groups in their study.

It was important that the data from the three groups were comparable.

Describe **two** variables that the scientists should have considered when selecting athletes.

1 .....

.....

2 .....

.....

[2]

**(e)** Starch is broken down into reducing sugars.

**(i)** Describe the method you would use to test for the presence of reducing sugars.

.....

.....

.....

..... [2]

**(ii)** State the reagent used to test for the presence of starch.

..... [1]

[Total: 22]

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