Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*9780290133*

**BIOLOGY** **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2020**

**2 hours**

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

**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 [ ].

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| Total | |

This document has **16** pages. Blank pages are indicated.


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Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish the whole of Question 1 and Question 2.

**1** Milk contains nutrients, including proteins, fats, carbohydrates, vitamins and minerals, that are essential for growth and development of young mammals.

When milk, **M**, is dropped into a test-tube containing copper sulfate solution, **CS**, the drop of milk sinks to the bottom of the test-tube. The rate at which the drop of milk sinks depends on the concentration of the milk.

You are provided with the materials shown in Table 1.1.

**Table 1.1**

| labelled | contents | hazard | volume / $cm^3$ |
|---|---|---|---|
| **CS** | copper sulfate solution | irritant | 200 |
| **M** | 100% milk | none | 50 |
| **W** | distilled water | none | 30 |
| **U** | milk sample of unknown concentration | none | 10 |

If **CS** comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

Carry out step 1 to step 3 to practise releasing **one** drop of **M** from a syringe.

1. Put 2 $cm^3$ of **M** into the syringe labelled **M**.

2. Hold the syringe containing **M** over an empty test-tube, as shown in Fig. 1.1. Push the plunger slowly to release **one** drop.

3. Repeat step 2 until you can release **one** drop at a time.

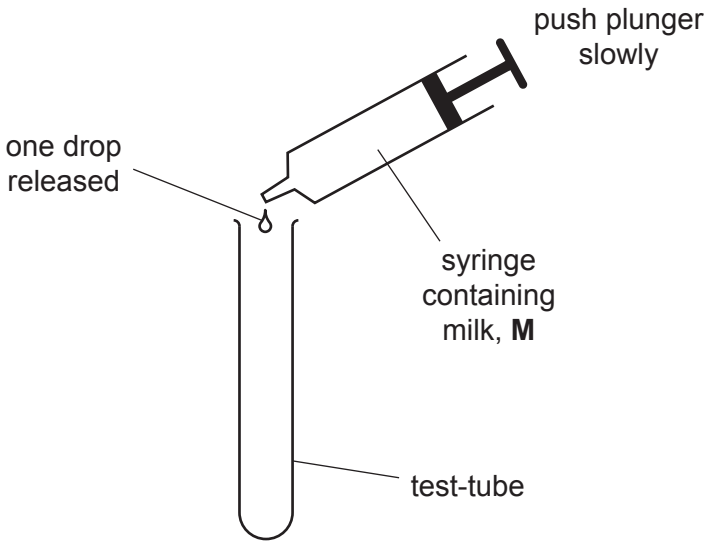



**Fig. 1.1**

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You will investigate the effect of changing the concentration of milk on the time taken for one drop of milk to sink through copper sulfate solution.

You will need to:

- prepare different concentrations of milk
- record the time taken for one drop of each concentration of milk to sink through copper sulfate solution, **CS**
- use your results to estimate the concentration of milk sample, **U**.

**(a)** You will need to use proportional dilution to make different concentrations of milk, **M**, between 90% and 50%.

You will need to prepare 10 $cm^3$ of each concentration, using **M** and **W**.

Table 1.2 shows how to make up two of the concentrations of milk you will use.

Decide which other concentrations of milk you will use.

**(i)** Complete Table 1.2 to show how you will prepare the concentrations of milk you will use.

**Table 1.2**

| percentage concentration of milk | volume of **M** / $cm^3$ | volume of **W** / $cm^3$ |
|---|---|---|
| 90.0 | 9.0 | 1.0 |
| | | |
| | | |
| | | |
| | | |
| 50.0 | 5.0 | 5.0 |

[2]

Carry out step 4 to step 14.

4. Prepare the concentrations of milk, as shown in Table 1.2, in the beakers provided.

5. Draw a line 2 cm from the top of a clean, dry test-tube, as shown in Fig. 1.2.

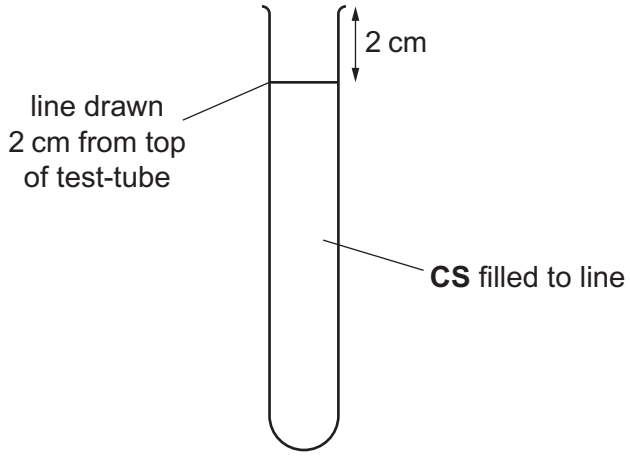



**Fig. 1.2**

6. Put **CS** into this test-tube up to the mark, as shown in Fig. 1.2.

7. Stir the 90% concentration of milk.

8. Put 2 $cm^3$ of the 90% milk into the syringe labelled **M**.

9. Put **one** drop of 90% milk into the test-tube containing **CS**, as shown in Fig. 1.3. Start timing.

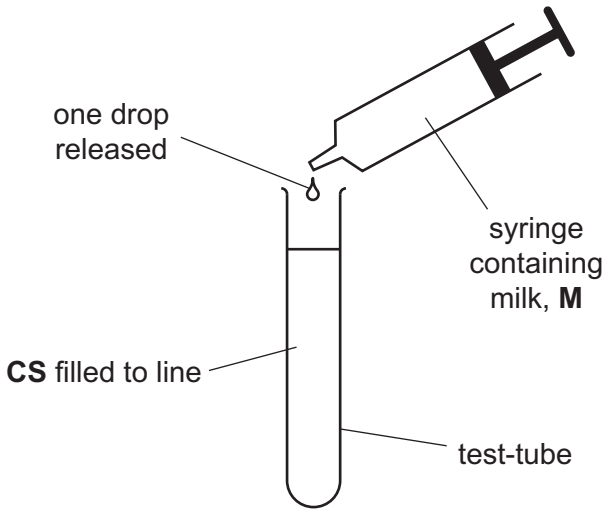



**Fig. 1.3**

10. Stop timing when the drop reaches the bottom of the test-tube.

    If the drop has not reached the bottom of the test-tube after 120 seconds, stop timing and record ‘more than 120’.

11. Record your result in **(a)(ii)**.

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12. Repeat step 9 to step 11 two more times, with 90% milk. This will give you three results for 90% milk.

13. Empty the contents of the test-tube into the container labelled **For waste**.

14. Repeat step 6 to step 13 for the other concentrations of milk you have prepared.

**(ii)** Record your results in an appropriate table, including raw results and processed (mean) results.

[5]

**(iii)** Describe the trend in your results.

.....

.....

..... [1]

You are provided with a sample of milk labelled **U**.

15. Repeat step 6 to step 10 using **U**.

16. Record your result for **U** in **(a)(iv)**.

**(iv)** Record the time taken for the drop of **U** to reach the bottom of the test-tube.

result for **U** = .....
[1]

**(v)** Using your results in **(a)(ii)** and **(a)(iv)** estimate the concentration of milk in **U**.

**U** = .....
[1]

Table 1.3 describes two sources of error when measuring the dependent variable in this investigation.

**(vi)** Complete Table 1.3 by:

- describing, for each error, an improvement to the procedure that reduces the effect of the error
- describing a third error and the improvement you would make to reduce its effect.

**Table 1.3**

| error | improvement |
|---|---|
| 1. Milk sometimes stays at the top of **CS** and may interfere with the movement of the next drop. | |
| 2. The drop sometimes sticks to the side of the test-tube and changes the time taken for the drop to reach the bottom. | |
| 3. ..... ..... ..... ..... | |

[4]

**(vii)** Error 2 in Table 1.3 states that 'the drop sometimes sticks to the side of the test-tube and changes the time taken for the drop to reach the bottom.'

State whether error 2 is a random error or a systematic error.
Give a reason for your answer.

type of error .....

reason .....

.....

[1]

**(b)** The milk produced by mammals contains fat globules.

Table 1.4 shows the mean fat globule diameter for the milk produced by different types of mammal.

**Table 1.4**

| type of mammal | mean fat globule diameter /μm |
|---|---|
| buffalo (B) | 8.8 |
| human (H) | 4.3 |
| camel (C) | 2.9 |
| goat (G) | 3.2 |
| sheep (S) | 3.7 |

**(i)** Plot a bar chart of the data in Table 1.4 on the grid in Fig. 1.4.

Use a sharp pencil for drawing bar charts.

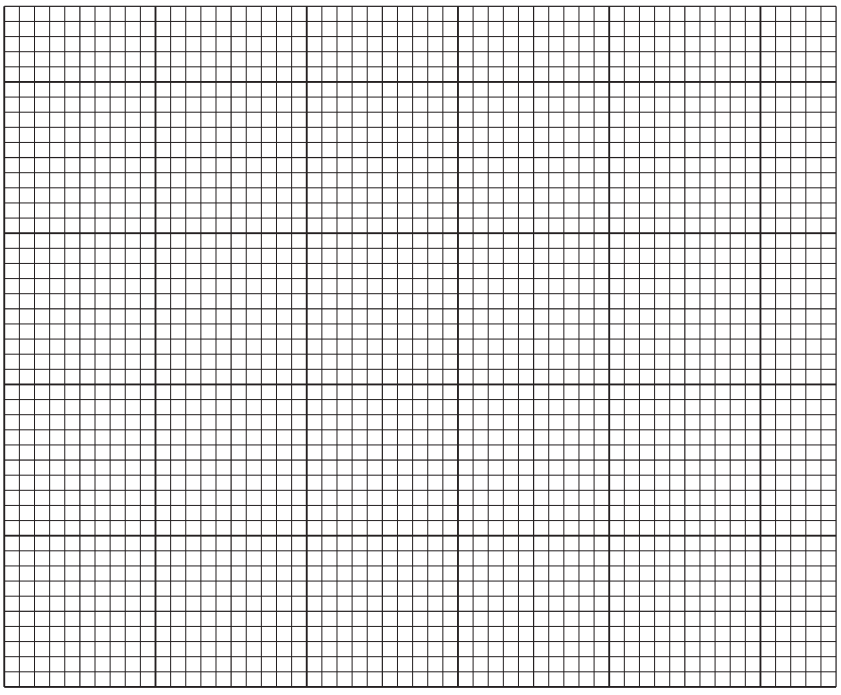


**Fig. 1.4**

[4]

**(ii)** Suggest which mammal milk in Table 1.4 contains fat that takes the longest time to be broken down by enzymes.

Explain your answer.

mammal .....

explanation .....

.....

.....

.....

.....

[2]

[Total: 21]

**Question 2 starts on page 10**

**2** Fig. 2.1 is a photomicrograph of a stained transverse section through a plant root.

You are not expected to be familiar with this specimen.



**Fig. 2.1**

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Use a sharp pencil for drawing.

You are expected to draw the correct shape and proportions of the different tissues.

**(a) (i)** Draw a large plan diagram of the region of the root section shown by the shaded area in Fig. 2.2.

Use **one** ruled label line and label to identify the endodermis.

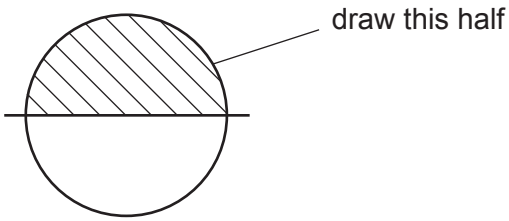



**Fig. 2.2**

[5]

**(ii)** **J1** is a stained transverse section through a root of a different type of plant.

You are not expected to be familiar with this specimen.

Observe the xylem vessel elements in the centre of the root section on **J1**.

Select **one** large xylem vessel element and **three** adjacent cells.

Each cell must touch at least one other cell.

- Make a large drawing of this group of **four** cells.
- Use **one** ruled label line and label to identify the lumen in **one** cell.

[5]

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**(b)** Identify observable similarities **and** differences between the root section in Fig. 2.1 and the root section on **J1**.

Record the observable similarities **and** differences in Table 2.1.

**Table 2.1**

| feature | Fig. 2.1 | J1 |
|---|---|---|
| similarities | | |
| differences | | |

[4]

**(c)** Fig. 2.3 is a photomicrograph of the same root section as in Fig. 2.1.

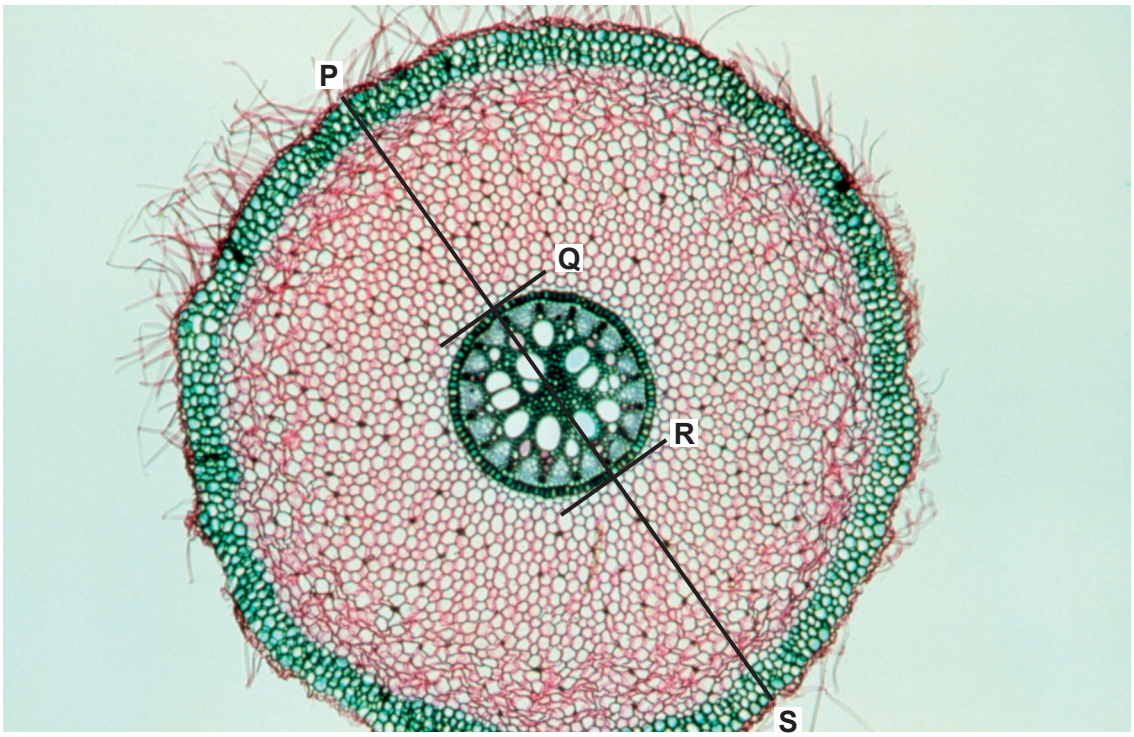



**Fig. 2.3**

The line **P**–**S** shows the diameter of the whole root section.

The line **Q**–**R** is the diameter of the vascular tissue.

Calculate the percentage of the diameter of the whole root section that is vascular tissue.

Show your working.

[5]

[Total: 19]

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