Surname	Centre Number	Candidate Number
First name(s)		2

GCE A LEVEL

1400U50-1A

S23-1400U50-1A

WEDNESDAY, 26 APRIL 2023

BIOLOGY – A2 unit 5
Practical Examination
Experimental Task
TEST 1

2 hours

For Teacher's use only Award a mark of 0 or 1 for each of the following	
Setting up of apparatus	
Measurement of distance	

For Examiner's use only	
Mark Awarded	
Total	

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01

ADDITIONAL MATERIALS

In addition to this examination paper, you will require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.
Pencil may be used to draw tables and graphs.
Write your name, centre number and candidate number in the spaces at the top of this page.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The total number of marks available for this task is 20.
Your teacher will directly assess your practical skills.
The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for orderly presentation in your answers.

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1. Aerobic respiration can be summarised as follows:

$$C_6H_{12}O_6 \quad + \quad 6O_2 \longrightarrow 6CO_2 \quad + \quad 6H_2O$$

The rate of respiration can be estimated by measuring the rate at which oxygen is absorbed by living cells.

In this practical you are going to estimate the rate of respiration of germinating mung beans.

Follow these instructions carefully

You are provided with:

30 × germinating mung beans
10 × pellets of solid sodium hydroxide ***
cotton wool
forceps
glass rod
1 × 20 cm^3 syringe with capillary tube attached
1 cm^3 of marker fluid in a suitable container
paper towels
stopclock
a non-permanent marker pen
30 cm ruler (± 1 mm)
eye protection

*** NOTE: Solid sodium hydroxide is highly corrosive. Forceps must be used to move the pellets.
Sodium hydroxide absorbs carbon dioxide.

YOUR TEACHER WILL BE OBSERVING YOUR EXPERIMENTAL TECHNIQUE.

Method

Follow steps **1** and **2** below to set up the apparatus shown in **Image 1.1**.

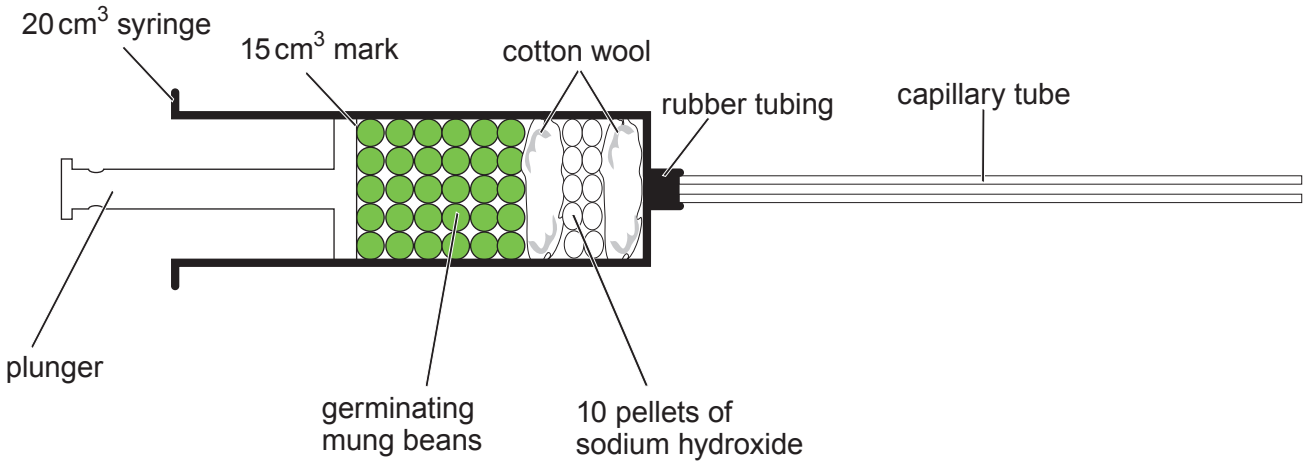
1. Remove the plunger and place a small piece of cotton wool in the syringe. Use the glass rod to push the cotton wool to the end of the syringe.

Use the forceps to place 10 pellets of sodium hydroxide on top of the cotton wool.

Place another small piece of cotton wool in the syringe and push to the end to cover the pellets of sodium hydroxide.

2. Place enough germinating mung beans in the syringe to reach the 15 cm^3 mark and push the plunger until it reaches the surface of the mung beans.

Image 1.1



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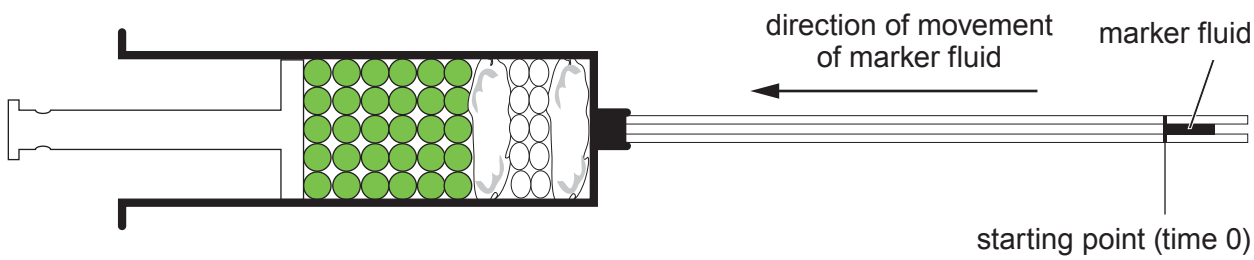
3. Leave the assembled apparatus for 2 minutes.

4. After 2 minutes, dip the open end of the capillary tube in the marker fluid so that a small volume of marker fluid enters the capillary tube as shown in **Image 1.2**.

5. Once the marker fluid is moving (this may be immediately) use the non-permanent marker to mark the position of the front of the marker fluid as the starting point (time 0) on the capillary tube and start the stopclock.

Image 1.2

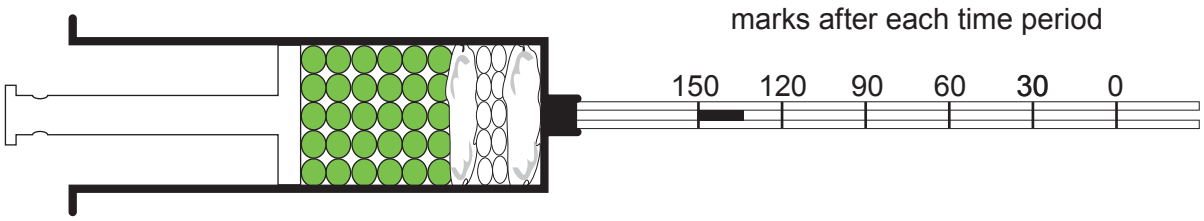


6. Mark the distance travelled by the marker fluid every 30 seconds for 150 seconds (i.e. at 30, 60, 90, 120 and 150 seconds).

Do not stop the stopclock when you mark each distance.

After 150 seconds the capillary tube should be marked in a similar way to that shown in **Image 1.3.**

Image 1.3



7. Measure and record the distance travelled by the marker fluid from **the starting point (time 0)** to each mark on the capillary tube, i.e. the distance travelled after 30, 60, 90, 120 and 150 seconds. Record your readings to the nearest mm.

8. Using a paper towel, wipe the marks off the capillary tube.

9. Gently pull the plunger to the 20 cm^3 mark and then push it back to the surface of the mung beans five times. (Note: this will pull the marker fluid out of the capillary tube so that it is absorbed by the cotton wool in the syringe.)

10. **Using the same apparatus** repeat steps **3** to **9** to obtain **two** more sets of readings.

Rough results:

Use the space below to record the total distance travelled by the marker fluid from the starting point after each time interval.

Calculate the mean total distance travelled by the marker fluid from the starting point after 30, 60, 90, 120 and 150 seconds.

Calculate the mean total volume of oxygen absorbed after 30, 60, 90, 120 and 150 seconds using the formula:

$$\text{volume of oxygen} = \pi r^2 h$$

where π = 3.14
r = 0.5 mm
h = mean total distance travelled by the marker fluid from the starting point

Examiner only

(a) Complete the table below to include:

- the units
- **all** of your readings
- the mean total distance travelled by the marker fluid from the starting point after each time interval
- the mean total volume of oxygen absorbed after each time interval to **one decimal place**. [4]

Time /	Total distance travelled by the marker fluid /				Mean total volume of oxygen absorbed / .....
	Trial 1	Trial 2	Trial 3	Mean	
0	0	0	0		
30					
60					
90					
120					
150					

Examiner only

(b) Draw a graph to show how the mean total volume of oxygen absorbed by the germinating mung beans changed over time. **Range bars are not required.** [7]

Examiner only

(c) (i) With reference to the role of sodium hydroxide and the equation for aerobic respiration, explain why the marker fluid moved towards the syringe. [2]

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(ii) Using your knowledge of **respiration**, explain the purpose of **step 9** in the method. [2]

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(iii) A suitable control experiment would be to repeat the experiment using boiled and cooled mung beans.

I. Explain why this would be a suitable control experiment. [1]

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II. Suggest the results you would expect from the control experiment. [1]

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(iv) Explain why using a set volume of beans in the syringe is a better control variable than using a set number of beans. [1]

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END OF PAPER

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