

Answers to 2018 O level Biology practical 6093/ Paper 3

The 2018 O level Biology practical paper had 2 questions. The first question was based on aerobic/ anaerobic respiration and the second question was based on a leaf and its associated structures/function.

Question 1

- a) Candidates were given a pH indicator which was a dark green solution. (**Teacher's Note! The indicator is bromothymol blue at pH 7.0**). Candidates were asked to blow into the pH indicator solution and record any changes.

Teacher's Note! When a person blows into bromothymol blue, the carbon dioxide from the exhaled air mixes with water to form carbonic acid. Bromothymol blue turns yellow in an acidic solution.

- b) (i) Candidates were given a yeast suspension maintained at about **34°C**. They were asked to draw 5 cm³ of this yeast suspension into a syringe, invert the syringe and draw a further 5 cm³ of air into the syringe. Using a flexible tubing, any gas given off by the yeast suspension in the syringe was bubbled into the pH indicator in a test tube and the time required for the indicator to change from dark green to yellow was recorded. After the indicator in the test tube turned yellow, the free end of the flexible tube was inserted into the pH indicator in a 2nd test tube and the time required for the indicator to change from dark green to yellow was recorded. This procedure was repeated for pH indicators in 3rd, 4th and 5th test tubes.

Test Tube	Start Timing	End Timing	Time required for pH indicator colour change	Mean Time
1			Approximately 360 seconds	Approximately 270 to 280 seconds
2			Approximately 300 seconds	
3			Approximately 240 seconds	
4			Approximately 240 seconds	
5			Approximately 240 seconds	

- (ii) Candidates were asked to repeat the experiment (b)(i) using a yeast suspension maintained at about **38°C**.

Test Tube	Start Timing	End Timing	Time required for pH indicator colour change	Mean Time
1			Approximately 120 seconds	Approximately 60 to 70 seconds
2			Approximately 60 seconds	
3			Approximately 60 seconds	
4			Approximately 60 seconds	
5			Approximately 60 seconds	

- c) Candidates were asked why the average time for the indicator to change colour (for either 34°C or 38°C) cannot be calculated from **all** the results in (b).

Teacher's Note! Average or mean time can only be used for readings that are replicated. Eg. 6.4 minutes, 6.8 minutes, 6.2 minutes, etc. The results in (b) clearly show that the readings are not replicated for the 1st and/or 2nd test tubes. As such, for (b)(i), **ONLY** results from test tubes 3, 4 and 5 may be used to determine the average time and for (b)(ii), **ONLY** results from test tubes 2, 3, 4 and 5 may be used.

- d) Thus, the mean rate of respiration using only the results that are replicated should be:

Temperature	Mean rate of respiration
34°C	Approximately 240 seconds
38°C	Approximately 60 seconds

- e) (i) Two similarities between the results in table (b)(i) and (b)(ii) are
- Time required for a colour change in the pH indicator decreases from test tubes 1 to 2.
 - Time required for a colour change in the pH indicator remains constant in test tubes 4 and 5.
- (ii) Two differences between the results in table (b)(i) and (b)(ii) are
- Time required for a colour change in the pH indicator is shorter in table (b)(ii) when compared with (b)(i).
 - Time required for a colour change in the pH indicator reaches a constant faster in table (b)(ii) when compared with (b)(i).

- f) A control for the above experiment can be set up by drawing 5 cm³ of sugar solution into a syringe instead of 5 cm³ of yeast suspension and recording the time taken for the pH indicator to change colour at 34°C and at 38°C.

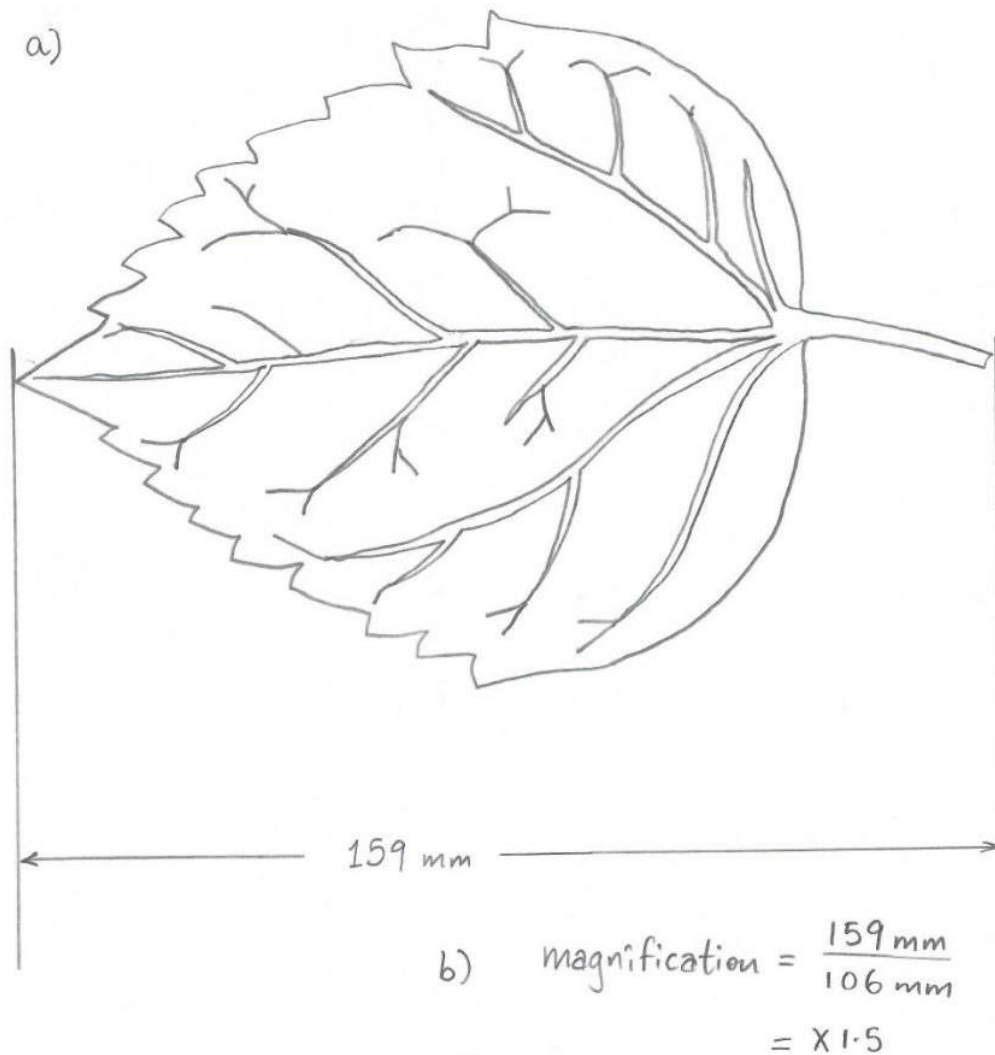
A control is important as it shows that the results are due to the effect of temperature on the yeast cells and are not caused by environmental or other factors.

- g) Two other ways that the rate of respiration could be measured are:
- by counting the number of bubbles given off in one minute;
 - by measuring the height of the foam above the yeast suspension after 1 minute.

h) Candidates were asked to describe a method to determine the effect of pH on the rate of respiration by yeast.

- From a yeast suspension maintained at 34°C in a water bath, measure out 5 cm³ into test tube A using a syringe.
- Add 5 cm³ of a solution with a pH of 1 into test tube A and shake the test tube.
- Cover the mouth of the test tube with a rubber bung that is attached to a delivery tube.
- Submerge the free end of the delivery tube in 5 cm³ of pH indicator solution and record the time taken for the indicator to change from dark green to yellow.
- Repeat the above steps for solutions with a pH of 4, 7, 10 and 14.
- Plot a graph of pH against time and determine the optimum pH when the time taken for colour change is the shortest.
- Use goggles to protect the eye as acids and alkalis are highly corrosive.

Question 2



Biological drawing of a Hibiscus leaf

- c) (i) A: **Stoma**
B: **Palisade cell**
C: **Cuticle**
D: **Xylem**
E: **Phloem (given)**

- d) **Large air spaces in the spongy mesophyll layer allow easy gas exchange (via diffusion) between photosynthesizing cells and the stomata.**