Light intensity and the rate of photosynthesis

Biology required practical | AQA Combined Science 8464 and AQA GCSE Biology 8461 | 14 questions, 35 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ **/ 35**

Aim: To find out how the distance of a lamp, and so the light intensity, affects the rate of photosynthesis in pondweed.

Equipment: Fresh pondweed (for example Elodea or Cabomba); Boiling tube in a rack; LED lamp (gives out very little heat); Metre ruler; Sodium hydrogencarbonate solution (supplies carbon dioxide); Paper clip to weigh the pondweed down; Stopwatch; Thermometer; Beaker of water (optional heat shield if a filament lamp is used).

Results

Tomasz and Priya placed a piece of pondweed in sodium hydrogencarbonate solution at 22 °C. They counted the bubbles released in one minute three times at each lamp distance.

Distance of lamp in cm	Bubbles per minute, count 1	Bubbles per minute, count 2	Bubbles per minute, count 3	Mean bubbles per minute
10	58	61	57	58.7
20	37	34	36	35.7
30	22	24	23	23.0
40	15	25	14	?
50	10	9	11	10.0

Questions

1 Look at Tomasz and Priya's investigation.

a. Name the independent variable.

b. Name the dependent variable.

(2 marks)

2 Give one control variable in this investigation and explain why it must be kept the same. (2 marks)

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3 Explain why the pondweed is placed in sodium hydrogencarbonate solution rather than plain tap water.

(2 marks)

4 Describe one hazard in this practical and how the risk can be reduced.

(2 marks)

5 Describe the pattern in the mean results.

(2 marks)

6 Identify the anomalous result in the table and say what Tomasz and Priya should do with it.

(2 marks)

7 Calculate the mean number of bubbles per minute at 40 cm. Do not include the anomalous result.

(2 marks)

8 Priya tried a longer count. With the lamp at 30 cm she counted 115 bubbles in 5 minutes. Calculate the rate of photosynthesis in bubbles per minute. Say whether it agrees with the table.

(2 marks)

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9 Calculate the percentage decrease in the mean rate when the lamp is moved from 10 cm to 50 cm.

Give your answer to the nearest whole number. Show your working.

(3 marks)

10 **Higher tier**

Light intensity is inversely proportional to the square of the distance from the lamp.

a. The lamp is moved from 10 cm to 30 cm. By what factor does the light intensity change?

b. Using relative light intensity = 10 000 / distance^2, calculate the relative light intensity at 40 cm.

Show your working.

(3 marks)

11 **Higher tier**

Halima repeated the investigation and found that moving the lamp from 10 cm to 5 cm made almost no difference to the rate. Explain why.

(3 marks)

12 Counting bubbles is not a very accurate way of measuring the rate. Suggest an improvement and explain why it gives a more accurate measurement.

(2 marks)

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13 The lamp in a second group's experiment was a filament bulb, and the temperature of their solution rose from 21 °C to 27 °C at the closest distance. Explain how this affects whether their results are valid.

(2 marks)

14 Plan an investigation to find out how the concentration of sodium hydrogencarbonate (carbon dioxide) affects the rate of photosynthesis in pondweed.

(6 marks)

End of questions | Total 35 marks | The answers sheet has the full method as revision notes.

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