pH and the rate of an enzyme reaction

Biology required practical | AQA Combined Science 8464 and AQA GCSE Biology 8461 | 14 questions, 36 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ **/ 36**

Aim: To find out how pH affects the rate at which the enzyme amylase breaks down starch, by timing how long it takes for the starch to disappear.

Equipment: amylase solution; starch solution (1%); buffer solutions covering pH 4 to pH 9; iodine solution in a dropping bottle; spotting tile; water bath set to 35 °C; test tubes and a test tube rack; 3 syringes or graduated pipettes (one for each solution); dropping pipette; stopclock; thermometer; glass rod.

Results

Hannah and Tariq timed how long the starch took to disappear at six different pH values. They sampled every 10 seconds and repeated each pH three times.

pH	Time on trial 1 in s	Time on trial 2 in s	Time on trial 3 in s	Mean time in s
4	280	300	290	290
5	150	140	150	147
6	70	80	70	73
7	50	40	50	47
8	90	100	160	X
9	220	240	230	230

Questions

1 Name the independent variable and the dependent variable in this investigation. (2 marks)

2 The tubes were kept in a water bath at 35 °C. Explain why the temperature had to be the same at every pH. (2 marks)

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3 Describe how the students knew that all the starch had been broken down. Give the colours.

(2 marks)

4 Give **one** hazard in this practical and describe how to reduce the risk.

(2 marks)

5 Look at the results for pH 8. Identify the anomalous result and give one possible reason for it.

(2 marks)

6 Calculate the value of X, the mean time at pH 8. Leave out the anomalous result.

(2 marks)

7 Calculate the rate of reaction at pH 6 using rate = 1000 ÷ mean time. Use the mean time in the table. Give your answer to 3 significant figures.

(2 marks)

8 A different way to work out a rate is rate = 1 ÷ time. Calculate the rate at pH 5 this way. Give your answer to 2 significant figures.

(2 marks)

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9 **Higher tier**

Each test used 5 cm^3 of 1% starch solution, which contains 0.05 g of starch.

Calculate the mean rate at which starch was broken down at pH 7, in g/s. Give your answer in standard form to 2 significant figures. Show your working.

(3 marks)

10 Describe the effect of pH on the rate of the reaction. Use data from the table in your answer.

(3 marks)

11 **Higher tier**

Explain why the reaction was very slow at pH 4.

(3 marks)

12 The students took a sample every 10 seconds.

a. Explain why this limits how accurate the times are.

b. Suggest an improvement and explain why it is better.

(3 marks)

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13 The students only tested whole-number pH values. They concluded that the optimum pH of amylase is exactly 7. Explain why this conclusion may not be correct and how they could find the optimum more precisely.

(2 marks)

14 Plan an investigation to find out how temperature affects the rate at which amylase breaks down starch.

(6 marks)

End of questions | Total 36 marks | The answers sheet has the full method as revision notes.

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