Practical Guide
Biology
Enzymes

This document contains:

- Links to YouTube clips showing the practical procedure
- Information from examination boards AQA, OCR, Edexcel
- Potential examination questions and answers

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Required practical – exam boards

- AQA

Required practical activity	Apparatus and techniques
Investigate the effect of pH on the rate of reaction of amylase enzyme. Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or immersible electric heater.	AT 1, AT 2, AT 5, AT 8

- Edexcel

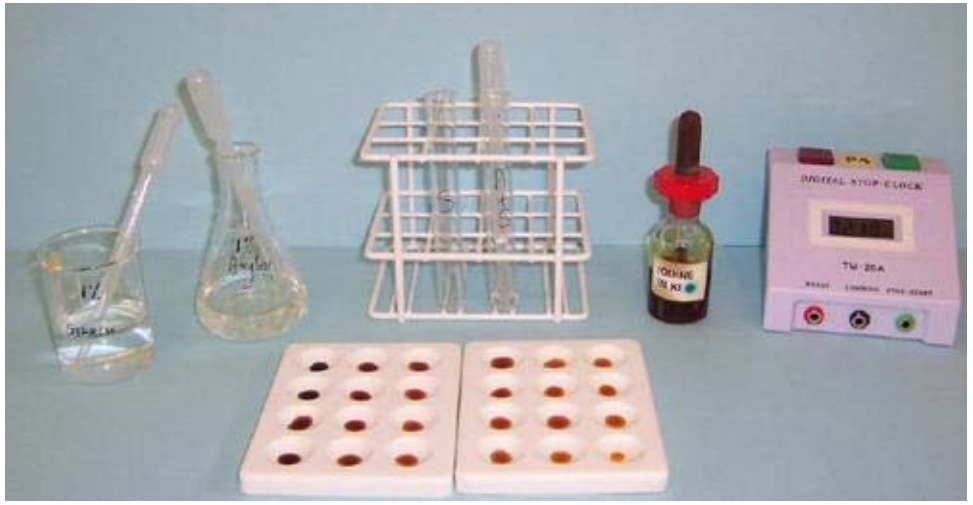
1.10	*Investigate the effect of pH on enzyme activity*	For this core practical students will investigate the effect of pH, however other variables can also be investigated to enhance practical work in this area. This method uses amylase (in solutions of different pH) to break down starch. The reaction can be monitored by using iodine to test the presence of starch in the solution with a continuous sampling method. To maintain the temperature of the solution, a Bunsen burner and water beaker must be used.

- OCR

PAG 4: Rates of enzyme-controlled reactions

Investigate the factors that can affect the rate of enzyme activity.

Practical procedure: Amylase and pH



Video 1

Video 2

Image from: http://www.nuffieldfoundation.org/practical-biology/investigating-effect-ph-amylase-activity

Possible examination style questions

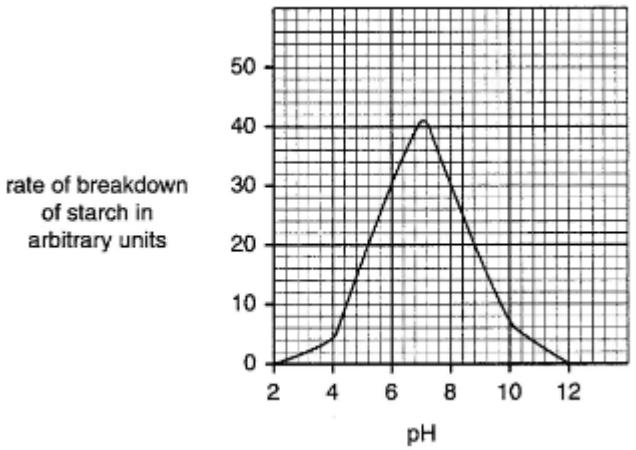
1. Plot a graph of this data:

pH	2	4	6	7	9	10	12
Rate of breakdown of starch by amylase/ arbitrary units	0	4	30	41	14	6	0

2. Use the graph to identify the optimum pH for amylase.
3. Describe how the rate of breakdown of starch changes as the pH increases.
4. Describe how you would monitor the reaction to identify when all the starch had been broken down.
5. Explain why there is a value of 0 for pH 2 and 12.

Possible examination style questions answers

1. Plot a graph of this data.



ANS:

- **Appropriate scales**
- **Labels on axes**
- **Points plotted correctly**

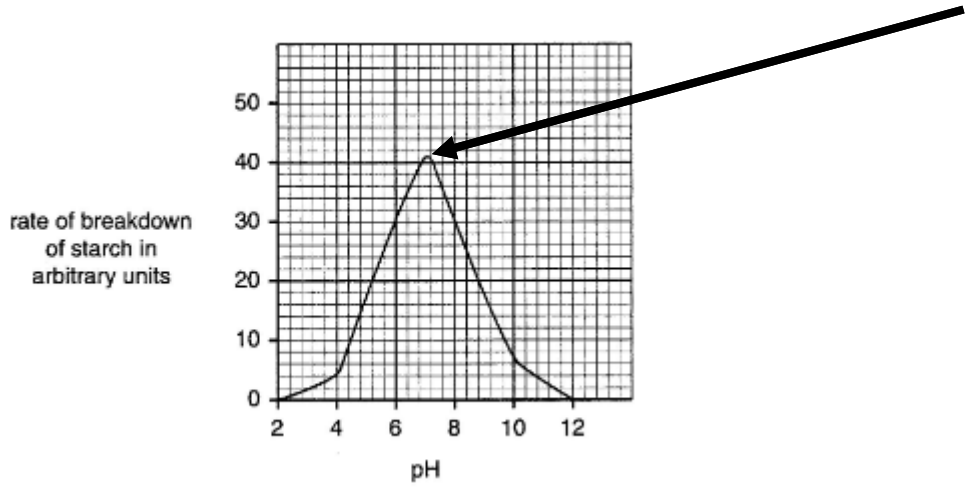
Possible examination style questions answers

2. Use the graph to identify the optimum pH for amylase.

ANS:

pH 7

Fastest rate of breakdown of starch



Possible examination style questions answers

3. Describe how the rate of breakdown of starch changes as the pH increases.

ANS:

- **Increasing pH increases the rate of reaction up to the optimum pH of 7**
- **After the optimum – as the pH increases the rate of reaction decreases**

Possible examination style questions answers

4. Describe how you would monitor the reaction to identify when all the starch had been broken down.

ANS:

- **Remove small samples from the reaction over time**
- **Test with iodine**
- **Turns blue/ black in presence of starch**
- **Orange/ brown when no starch present**

Possible examination style questions answers

5. Explain why there is a value of 0 for pH 2 and 12.

ANS:

- **Enzymes are proteins**
- **Denatured**
- **Substrate no longer fits in the active site**

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Key questions:

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- Why is iodine solution used?
- Why are syringes used to measure the volumes of the solutions?
- Why does the mixture need to be stirred?
- Why are the solutions added in the order stated? (amylase solution, pH solution and starch solution)
- Why is the timer started after the starch solution is added?
- Why must the syringes be used in the same solutions when the investigation is repeated?
- What are the main errors in this procedure?
- How can you improve the procedure?
- What other factors could have affected the results?
- How is the rate of reaction being measured?
- What safety precautions are used in the practical?

http://qualifications.pearson.com/content/dam/pdf/GCSE/Science/2016/teaching-and-learning-materials/GCSE-9-1-Sciences-core-practical-guide.pdf

Summary document

A summary document is also available on Huddle which contains all the relevant information about this practical from the different examination boards. This document includes practical methods and other potential examination questions