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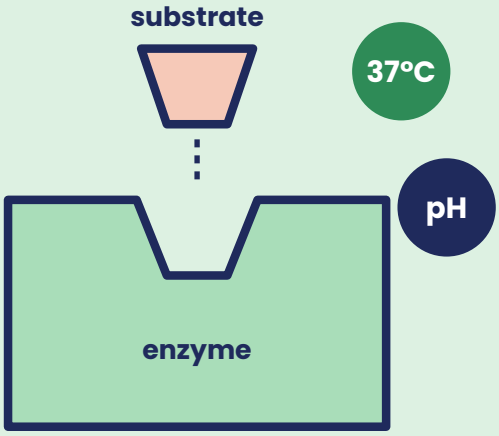
Year 10–11 • Cambridge IGCSE Biology 0610




# Enzymes

## Mark Scheme – Teacher Copy

Answers, marking points and guidance for the Enzymes topic practice paper (Cambridge IGCSE Biology 0610 style).

Catalysts | Active site | Temperature | pH | Denaturing | Practicals

KEY IDEAS IN THIS PAPER

CORE + EXTENDED

Name: _____ Class: _____

Date set: _____ Date due: _____

## What's inside


| | | |
|---|---|---|
| **Question 1** | Enzymes and the active site | **9 marks** |
| **Question 2** | The effect of temperature on amylase | **13 marks** |
| **Question 3** | The effect of pH | **8 marks** |
| **Question 4** | Catalase in potato (practical) | **8 marks** |
| **Question 5** | How enzymes work [Extended] | **7 marks** |


### Marking notes

- ; separates marking points. / separates alternatives.
- ( ) words in brackets are not needed for the mark.
- ecf = error carried forward from an earlier part.
- Accept any correct, clearly expressed alternative.

**Total marks**

**45**

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# Enzymes – Mark Scheme

Maximum mark: 45 (Core: 31). ";" separates marking points. Accept correct alternative wording. Apply error carried forward (ecf) where shown.

## Question 1 – Enzymes and the active site

| Q | Answer | Mark | Guidance |
|---|---|---|---|
| **1(a)** | increases the rate of a (chemical) reaction;<br>is not changed by the reaction; | 2 | allow: speeds up a reaction; not used up |
| **1(b)** | protein; | 1 | |
| **1(c)** | to make (metabolic) reactions fast enough to keep the organism alive; | 1 | allow: reactions would be too slow without them |
| **1(d)** | (i) A;<br>(ii) B;<br>(iii) D; | 3 | C is the enzyme (in the enzyme-substrate complex); do not allow C for (i)–(iii) |
| **1(e)** | the active site has a specific shape;<br>only one substrate is complementary to / fits the active site; | 2 | do not allow: "same shape" as the substrate |
| | **Total** | **9** | |

## Question 2 – The effect of temperature on amylase

| Q | Answer | Mark | Guidance |
|---|---|---|---|
| **2(a)(i)** | blue-black; | 1 | allow: black / dark blue |
| **2(a)(ii)** | orange / brown / yellow-brown; | 1 | do not allow: “colourless” or “clear” |
| **2(b)** | 16.7; | 1 | allow 17 or 16.6 |
| **2(c)** | all 6 points plotted correctly to within half a small square;;<br>points joined with straight lines (ruled); | 3 | 2 marks for all 6 correct, 1 mark for 4–5 correct; ecf from 2(b) |
| **2(d)** | 40 (°C); | 1 | allow: a value from 35 to 45 that matches the student’s graph |
| **2(e)** | enzyme and substrate molecules have more kinetic energy / move faster;<br>more frequent (effective) collisions / more enzyme-substrate complexes formed per second; | 2 | do not allow: “more collisions” without the idea of time / frequency |
| **2(f)** | amylase is denatured;<br>(shape of) active site changes;<br>starch no longer fits / is no longer complementary (so no enzyme-substrate complexes form); | 2 | any two; do not allow: enzyme is killed |
| **2(g)** | any two from: volume / concentration of starch; volume / concentration of amylase; pH; time between tests; size of iodine drop; | 2 | do not allow: temperature (this is the independent variable) |
| | **Total** | **13** | |

## Question 3 – The effect of pH

| Q | Answer | Mark | Guidance |
|---|---|---|---|
| **3(a)** | 2; | 1 | allow: 1.8–2.2 |
| **3(b)** | the stomach is acidic / has hydrochloric acid / low pH; | 1 | |
| **3(c)** | 55 (%); | 1 | allow: 52–58 |
| **3(d)** | pH 10 is far from the optimum (pH 7);<br>shape of the active site changes / enzyme is denatured;<br>substrate does not fit / fewer enzyme-substrate complexes form; | 3 | do not allow: enzyme is killed |
| **3(e)** | substrate: starch;<br>product: (simple) sugars / maltose; | 2 | do not allow: glucose (alone) for product |
| | **Total** | **8** | |

## Question 4 – Catalase in potato

| Q | Answer | Mark | Guidance |
|---|---|---|---|
| **4(a)** | oxygen; | 1 | |
| **4(b)** | glowing splint relights; | 1 | test and result needed for the mark |
| **4(c)** | no foam / zero height;<br>catalase is denatured (by boiling); | 2 | allow: active site has changed shape |
| **4(d)** | so the surface area / amount of catalase is the same / fair test; | 1 | |
| **4(e)** | use a water bath (at a set temperature); | 1 | allow: carry out in the same room at the same time |
| **4(f)** | wear eye protection / goggles; | 1 | allow: wear gloves; avoid contact with skin |
| **4(g)** | to identify anomalous results / calculate a mean / check results are repeatable; | 1 | do not allow: “to make it a fair test” |
| | **Total** | **8** | |

## Question 5 – How enzymes work [Extended]

| Q | Answer | Mark | Guidance |
|---|---|---|---|
| **5(a)** | substrate collides with / fits into the active site (of the enzyme);<br>(because) the shapes are complementary;<br>an enzyme-substrate complex forms;<br>substrate is broken into products, which leave the active site; | 3 | any three; allow: enzyme can be used again |
| **5(b)** | at 5 °C the enzyme is inactive / has low kinetic energy but is not denatured;<br>at 80 °C the enzyme is denatured (so it cannot work even when cooled); | 2 | allow: denaturing is permanent / cannot be reversed |
| **5(c)(i)** | protease breaks down protein (in the stain) into amino acids, which are soluble / wash away; | 1 | |
| **5(c)(ii)** | the enzymes are denatured at 90 °C; | 1 | |
| | **Total** | **7** | |

**Paper total: 45** | Core total: 31 | Extended-only marks: 1(e), 2(e), 3(d), Q5