# GCSE and IGCSE Biology: Enzymes Worksheet - Mark Scheme

Year 10-11 · GCSE (AQA 4.2.2) and Cambridge IGCSE 0610 topic 5 · Exam-style questions

## Section A: Enzyme basics [21 marks]

| | | |
|---|---|---|
| **1(a)** | catalysts | **1** |
| **1(b)** | protein | **1** |
| **1(c)** | active site | **1** |
| **1(d)** | substrate | **1** |
| **1(e)** | specific | **1** |
| **1(f)** | denatured | **1** |
| **2** | The active site has a specific shape (1). Only a substrate with a complementary shape fits into it (1) to form an enzyme–substrate complex, and then the reaction happens (1). | **3** |
| **3** | Amylase: starch; maltose (or sugars); salivary glands and pancreas. Protease: proteins; amino acids; stomach, pancreas and small intestine. Lipase: lipids (fats and oils); fatty acids and glycerol; pancreas and small intestine.<br>Guidance: 1 mark for each correct box (12 boxes). Accept equivalent: maltose then glucose. | **12** |

## Section B: Factors affecting enzymes [10 marks]

| | | |
|---|---|---|
| **4** | Particles gain kinetic energy and move faster (1); more frequent collisions between enzyme and substrate (1); more successful collisions so the rate increases (1). | **3** |
| **5** | The bonds holding the enzyme’s shape break (1); the active site changes shape (1); the substrate no longer fits so the enzyme is denatured and cannot be reused (1). | **3** |
| **6** | Each enzyme has its own optimum pH (1) that suits the conditions where it works: stomach is acidic and the small intestine is alkaline (1). | **2** |
| **7** | The pH interferes with the bonds that hold the enzyme in shape (1) so the active site changes shape and the enzyme is denatured (1). | **2** |

## Section C: Interpreting data [9 marks]

| | | |
|---|---|---|
| **8(a)** | 40 °C | **1** |
| **8(b)** | 1000 ÷ 100 (1) = 10 (units per second) (1) | **2** |
| **8(c)** | Amylase is denatured (1) because high temperature changes the shape of the active site (1). | **2** |
| **8(d)** | Test more temperatures between 30 °C and 50 °C (e.g. 35, 40, 45). | **1** |
| **8(e)** | Any two: volume and concentration of starch; volume and concentration of amylase; pH; time between testing. | **2** |
| **8(f)** | Drop of solution no longer turns blue-black with iodine. | **1** |

## Section D: Applications and calculation [9 marks]

| | | |
|---|---|---|
| **9** | Advantage: remove protein and fat stains at lower temperatures, saving energy (1).<br>Disadvantage: they are denatured at high temperatures / can cause allergic reactions (1). | **2** |
| **10** | Lactase breaks lactose into glucose and galactose (1); lactose-intolerant people cannot make enough lactase (1); so the sugars can be absorbed without causing symptoms (1). | **3** |
| **11** | All active sites are occupied / enzyme concentration is the limiting factor (1) so more substrate does not increase the rate (1). | **2** |
| **12** | (14 ? 8) ÷ 8 × 100 (1) = 75% (1) | **2** |

**Total: 49 marks. Accept any scientifically correct alternative wording.**