



# Enzymes

## Mark Scheme 4

|            |                         |
|------------|-------------------------|
| Level      | IGCSE                   |
| Subject    | Biology                 |
| Exam Board | CIE                     |
| Topic      | Enzymes                 |
| Paper Type | (Extended) Theory Paper |
| Booklet    | Mark Scheme 4           |

Time Allowed: 68 minutes

Score: /56

Percentage: /100

- 1 (a) ref. to biological ;  
catalyst AW ;  
ref. to protein nature AW ; **[max. 2]**
- (b) (i) ref. to stains may be protein / fat / not removable with detergent only AW ;  
ref. to presence of lipase ;  
breaks down fat (stain) + to form fatty acids and glycerol ;  
ref. to presence of protease ;  
breaks down protein (stain) + to form amino acids ;  
ref. to products being soluble AW ; **[max. 3]**
- (ii) high temperature denatures enzymes ;  
so enzymes will not work AW ;  
low temperature + enzymes work slowly AW ;  
appropriate explanation e.g. ref to kinetic energy of molecules ;  
ref, to constant temperature maintains optimum conditions AW ; **[max. 3]**
- (iii) **TEMPERATURE AND EXPLANATION NEEDED FOR THE MARK** around 37°C + ref. to optimum temperature for enzyme action ;  
Ⓐ refs. to higher temperatures (up to 70°C with suitable explanation e.g. modified to withstand high temperatures) **[1]**
- (c) ref. to fermenter ;  
ref. to source of enzyme e.g. yeast / fungus / bacteria ;  
ref. to feedstock / starch solution ;  
ref. to suitable conditions – air bubbled ;  
ref. to suitable conditions – stirring ;  
ref. to intracellular enzymes + microbes filtered ;  
then crushed and extracted ;  
ref. to extracellular enzymes + extracted from filtered feedstock ; **[max. 4]**
- [max. 13]**

|       |  |                             |                               |
|-------|--|-----------------------------|-------------------------------|
| 2 (a) | <p><i>method of pollination:</i><br/>wind ;</p> <p><i>explanation to max 2:</i><br/>Feathery / AW, stigma ;<br/>long, filament ;<br/>large, anthers / stamens ;<br/>anthers / stamens, hang outside flower ;<br/>anthers loosely attached (to filament) ;<br/>light pollen ;<br/>no petals ;</p> | <p>[1] +</p> <p>max [3]</p> | <p><b>A</b> 'only bracts'</p> |
|-------|--|-----------------------------|-------------------------------|

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| Question | Answer   | Marks             | Additional Guidance  |
|----------|--|-------------------|--|
| 2 (b)    | cross (pollination) ;  | [1]               |  |
| (c)      | pollen tube ;<br>delivers male gamete / pollen <u>nucleus</u> / male <u>nucleus</u> to ovule ; AW  | [2]               | <b>A</b> female gamete/egg/female nucleus/ovum.  |
| (d)      | <i>idea that</i> tip of pollen tube opens / AW ;<br>gametes/sex cells/ova and pollen <u>nuclei</u> fuse / join / combine ;<br>formation of zygote ;<br>diploid ; | max [2]           | <b>A</b> male nucleus for pollen nucleus<br><b>ignore</b> pollen unqualified<br><b>ignore</b> meet/mix |
| (e) (i)  | ovule ;  | [1]               |  |
| (ii)     | ovary (wall) ;   | [1]               |  |
| (iii)    | colonise new areas ;<br>reduce (intraspecific) competition ;<br>reduce inbreeding ; <b>ora</b>   | max [1]           |  |
| (f)      | stored food/food reserves (in seed) broken down ;<br>named enzyme plus substrate ;<br>product plus use ;<br>enzymes required in process of respiration ;         | max [2]           |  |
|          |  | <b>[Total:13]</b> |  |

| Question   | Answer  | Marks    | Additional Guidance   |  |          |  |          |   |          |  |          |   |          |   |  |
|--|---|----------|---|--|----------|--|----------|---|----------|--|----------|---|----------|---|--|
| 3 (a)  | <b>A</b> – (waxy) cuticle;<br><b>B</b> – palisade mesophyll / palisade layer / palisade cell;<br><b>C</b> – (lower) epidermis / epidermal layer;<br><b>D</b> – stoma / stomata / guard cell(s);<br><b>E</b> – air / gas, space;   | 5        | <b>I</b> outer layer / AW<br><b>R</b> mesophyll / palisade unqualified<br><br><b>R</b> (spongy) mesophyll |  |          |  |          |   |          |  |          |   |          |   |  |
| (b)  | <table><tr><td>function</td><td>letter from Fig. 1.2</td></tr><tr><td>controls movement of substances into and out of the cell</td><td><b>G</b></td></tr><tr><td>creates a pressure to maintain the shape of the cell</td><td><b>K</b></td></tr><tr><td>produces sugars using light as a source of energy</td><td><b>L</b></td></tr><tr><td>withstands the internal pressure of the cell</td><td><b>J</b></td></tr><tr><td>controls all the activities of the cell</td><td><b>F</b></td></tr></table> | function | letter from Fig. 1.2  | controls movement of substances into and out of the cell | <b>G</b> | creates a pressure to maintain the shape of the cell | <b>K</b> | produces sugars using light as a source of energy | <b>L</b> | withstands the internal pressure of the cell | <b>J</b> | controls all the activities of the cell | <b>F</b> | 5 |  |
| function   | letter from Fig. 1.2  |          |   |  |          |  |          |   |          |  |          |   |          |   |  |
| controls movement of substances into and out of the cell | <b>G</b>  |          |   |  |          |  |          |   |          |  |          |   |          |   |  |
| creates a pressure to maintain the shape of the cell     | <b>K</b>  |          |   |  |          |  |          |   |          |  |          |   |          |   |  |
| produces sugars using light as a source of energy        | <b>L</b>  |          |   |  |          |  |          |   |          |  |          |   |          |   |  |
| withstands the internal pressure of the cell             | <b>J</b>  |          |   |  |          |  |          |   |          |  |          |   |          |   |  |
| controls all the activities of the cell                  | <b>F</b>  |          |   |  |          |  |          |   |          |  |          |   |          |   |  |

| Question  | Answer  | Marks       | Guidance for Examiners  |
|-----------|---|-------------|---|
| 3 (c) (i) | volume of, oxygen / gas, increases (with time);<br>levels off / reaches a plateau / AW;<br>increases rapidly at start and then slows down;<br>use of data;  | max 3       | I 'reaction stops'<br><br>e.g. levels off at 6.2 cm <sup>3</sup> of oxygen at 90 seconds<br>data quotes must have units   |
| (ii)      | substrate / hydrogen peroxide / reactant / AW, fits into enzyme;<br>active site;<br>shape is, complementary / AW;<br>any reference to lock and key;<br>product(s) / oxygen and water, formed and leaves the enzyme;<br>AVP; | max 3       | A answers in the context of catalase<br>I 'speeds up the reaction'<br>R if shape is the same<br><br>A product and enzyme separate<br>e.g. enzyme can work again / enzyme not used up / enzyme is not changed during reaction / lowers activation energy |
|           |   | [Total: 16] |   |

|   |     |      |   |   |         |  |
|---|-----|------|---|---|---------|--|
| 4 | (a) | (i)  | amylase <b>A</b> carbohydrase   |   | [1]     | <b>Ig</b> odd spelling   |
|   |     | (ii) | 1   | starch is not soluble / large /complex      | [max 2] | Mpt 2 <b>A</b> ecf from (i) / carbohydrase / enzyme to digest starch |
|   |     |      | 2   | fungus does not, secrete / produce, amylase |         |  |
|   |     |      | 3   | for absorption (of glucose) / AW            |         |  |
|   |     |      | 4   | ref to, respiration / growth, (of fungus)   |         |  |
|   |     |      | 5   | as nutrient, for fungus / fermentation / AW |         |  |
|   | (b) | 1    | other fungi / bacteria / virus / other microorganisms                   |   | [max 2] | <b>R</b> contaminate unqualified                                     |
|   |     | 2    | compete for nutrients   |   |         |  |
|   |     | 3    | reduce productivity / yield / quality                                   |   |         |  |
|   |     | 4    | contaminate the product / produce toxic <i>or</i> harmful product / ORA |   |         |  |
|   |     | 5    | stop the process (early) and sterilise fermenter                        |   |         |  |

|             |     |  |         |  |
|-------------|-----|--|---------|--|
| 4           | (c) | <p>2 energy is lost, between / within, trophic levels / along food chain</p> <p>3 animals are, at second trophic level / primary consumers OR plants are, autotrophs / producers / first trophic level</p> <p>4 (energy lost) in animal respiration / heat / (named) metabolic process / movement</p> <p>5 ref to (more) material that is inedible / not digestible (in longer food chains)</p> <p>6 ref to 10% energy transfer / ORA</p> <p>7 less pollution (from farm animal waste)</p> | [max 3] | <p><b>lg</b> ref to healthy diet</p> <p>ref to 100→10→1</p> <p>Mpt 6 <b>A</b> plants use CO<sub>2</sub></p>                              |
|             | (d) | <p>1 cheaper</p> <p>2 requires less energy as less is lost along food chain</p> <p>3 mycoprotein can be made anywhere / less land (in fermenters)</p> <p>4 less (animal) waste</p> <p>5 better for animal welfare / more ethical</p> <p>6 lower in fat / lowers risk of <u>heart</u> disease</p> <p>7 suitable for, vegetarians / vegans</p> <p>8 AVP e.g. quicker, contains fibre, disease free</p>   | [max 3] | <p><b>Note:</b> Use list rule</p> <p><b>R</b> longer shelf life, help food shortages, more protein, more nutrients, easier to digest</p> |
|             | (e) | <p>1 mycoprotein / fungus production requires supply of corn (starch)</p> <p>2 this comes from crop plants</p> <p>3 (fungus) still need to be grown</p> <p>4 (manufacture) requires energy</p> <p>5 rate of food supply cannot keep up due to overpopulation</p> <p>6 AVP e.g. does not contain all nec nutrients, may be consumer resistance to eating mycoprotein foods / needs flavourings / unbalanced diet</p>  | [max 3] | <p><b>R</b> required machinery</p>   |
| [Total: 14] |     |  |         |  |