Enzymes

Mark Scheme 2

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Sub-Topic	
Paper Type	Alternative to Practical
Booklet	Mark Scheme 2

Time Allowed: **56 minutes**

Score: **/46**

Percentage: **/100**

<table>
<tr><th>Question</th><th>Answer</th><th>Mark allocation</th><th>Guidance</th></tr>
<tr><td>1 (a) (i)</td><td>
<table>
<tr><td rowspan="2">Mass of tissue g</td><td colspan="2">Volume of oxygen cm^3 per 4 minutes</td></tr>
<tr><td>Sweet potato</td><td>Irish potato</td></tr>
<tr><td>2.0</td><td>3</td><td>12.5</td></tr>
<tr><td>2.0</td><td>2</td><td>9.0</td></tr>
<tr><td>2.0</td><td>3</td><td>8.5</td></tr>
<tr><td>2.0</td><td>2</td><td>10.0</td></tr>
<tr><td>total</td><td></td><td>40.0 ;</td></tr>
<tr><td>mean</td><td>28</td><td>10.0 ;</td></tr>
</table>
</td><td>[2]</td><td></td></tr>
<tr><td>(ii)</td><td>Larger surface or area / to release more enzyme / faster reaction;</td><td>[1]</td><td>Accept enough surface area to react
Ignore to make the tissues more uniform in texture / easier to measure / reference to skin of potato
Accept more contact
Ignore easier reaction</td></tr>
</table>

Question	Answer	Mark allocation	Guidance
(b) (i)	Simple column graph to show the range of readings for the sweet potato. **A –** labelled axes with units**;** **S –** scale**;** **P –** accurate plot of columns, ±½ square**;** **B –** neat bars of equal width, not touching and equal interspaces**;** **M –** mean line shown ± ½ square**;**	**[5]**	 **A – accept** experiment and volume gas or O_2 / cm^3 – numbers should be placed centrally under column **S –** scale on *y* axis must be even and bars plotted to fill half or greater than half of grid on both axes. **Ignore** orientation of bars **P – deduct** mark if any incorrect **Accept** line columns Mean line does not need to be labelled If line graph allow **A, P** and **M** only **max 3** If results for Irish potato allow **A, B** and **M** only
(ii)	**two from:** reference to temperature**;** different tubers / part of tuber / amounts catalase**;** reference to pH**;** difference in surface area**;** gas or oxygen escaping or difficulties in accurate measurement of gas volume / AW**;**	**[2]**	**Ignore** 'conditions were not the same' unless qualified **Ignore** references to activity / concentration of H_2O_2 **Accept** enzymes for catalase **Ignore** different amounts of potato **Accept** correct reference to size or no: pieces for surface area **Ignore** difficulties in reading measurements

Question	Answer	Mark allocation	Guidance
(c)	**Two from:** **S:** use of water bath / AW; **E:** correct reference to maintaining temperature / AW; **S:** use of stopwatch / data logger / computerised or monitoring system / AW; **E:** correct reference to accurate timing / AW; **S:** use of stirring device / same agitation or shaking / AW; **E:** to avoid tissue settling on bottom of flask; **S:** use the same size / similar apparatus; **E:** different apparatus or sizes would affect result; **S:** use burette / syringe / pipette / AW; **E:** for accurate measurement of volume of hydrogen peroxide; **S:** cut even size potato pieces / grind potato / AW; **E:** to keep surface area the same / AW; **S:** add buffer / pH controller / acid or alkali / AW; **E:** to maintain constant pH / AW; **S:** use funnel through bung to add H_2O_2 / AW; **E:** to save removing bung / prevent gas escape; **S:** use same concentration H_2O_2; **E:** to control substrate / make the experiment the same; **S:** repeat **more** times; **E:** to reduce anomalies / AW; AVP;	**[max 4]** **[Total:14]**	***Mark in couplets – improvement with appropriate explanation*** If not in couplets, **max 2** for **S** or **E** answers only **Ignore** more frequent / longer timings **Accept** maximising surface area for 'grinding' potato **Accept** reduce mistakes **Ignore** use of different tissues / plants

<table>
<tr><th>Questions</th><th>Answer</th><th></th><th>Guidance/comments</th></tr>
<tr><td>2 (a) (i)</td><td>
<table>
<tr><th>temperature / °C</th><th>volume of juice collected / cm^3</th></tr>
<tr><td>10</td><td>2</td></tr>
<tr><td>15</td><td>11</td></tr>
<tr><td>20</td><td>15</td></tr>
<tr><td>25</td><td>20</td></tr>
<tr><td>30</td><td>26</td></tr>
<tr><td>5</td><td>27</td></tr>
</table>
;;;</td><td>[3]</td><td>Lose 1 mark for each error.</td></tr>
<tr><td>(ii)</td><td>Graph plot A – axes – orientation and labels;

S – suitable scale, plots to fill ½ or > ½ grid;

P – plots;;

L – neat line passing through all points;</td><td>[5]</td><td>x-axis - temperature / °C and y-axis – volume / cm³

If incorrect scale penalised allow correct plot for that scale.

+/– 0.5 square for points and line. Lose 1 mark for each error.

Point to point ruled line or smooth curve passing through all points. No extrapolation.
Allow e.c.f.</td></tr>
<tr><td>(iii)</td><td>increase in temperature – greater volume of juice collected
ORA;
almost the same volume / lowest increase in volume between 30 °C and 35 °C / AW;
larger volume / largest increase between 10 °C and 15 °C;</td><td>[max 2]</td><td>I. direct quotes of figures, need tren
I. reference to optimum
I. flattens at 35 °C</td></tr>
</table>

(b)	**1.** range of different pHs; **2.** detail of method planned / control of pH – use of buffers; **3.** same type pulp or apple or same volume / amount pulp or apple; **4.** same volume / mass of enzyme; **5.** same concentration enzyme; **6.** same temperature; **7.** same timings; **8.** filtration; **9.** allow for repeat readings; **10.** calculate mean; **11.** plot data in graph form; **12.** safety feature e.g. goggles / lab. coat / tongs;	[max 6]	Need reference to minimum 3 different pHs **A**. several / man **A**. methods to alter pH e.g. using different (named) acid and / or alkalis or changing amounts / drops / volumes of acids and / or alkalis **I**. record the data **I**. glove 'Keep all conditions the same' = 1 if no marks awarded for points **3, 4, 5, 6 or 7.**
		[Total: 16]	

3 (a) (i)	Graph: O orientation and label of axes; S suitable scale to fill > 1/2 grid; P plot points; L neat line passing through plotted points; [4]	bar chart = MAX 1 for Orientation mark pH on X–axis (ignore PH) and time/ s on Y-axis; judged by plotted points and scale should be linear including broken axis. +/- 0.5 square for all points / line point to point ruled line or smooth curve passing through all points. No extrapolation of line.
(ii)	record optimum / 7 – faster / best; increase rate, pH 3-7 / more alkaline **or** decrease rate, pH 7 – 3 / more acidic; decrease rate, pH 7-8 /more alkaline **or** increase rate, pH 8 – 7 / more acidic / less alkaline; AVP; [MAX 2]	If refer to extreme pH's **only** – Max 1 i.e. rate decreases from pH 7 to pH 3 and **e**.g. can't be exactly sure of optimum as not enough poin around pH 7
(b)	Four from: 1. contro temperature; 2. same size of apparatus / tube; 3. same size / type / mass of paper / concentration of catalase; 4. buffe 5. more sophisticated timer / stopwatch / data logger; 6. safety features includes use forceps to handle pieces of paper / goggles / gloves / lab coats / AW; 7. repeat 8. volume of oxygen measured / collected; 9. increase intermediate pH / values between 3 and 8; [MAX 4]	If all conditions and environment the same allow Max 1 for Points 1 & 2. **I** clean apparatus **A** find average / two people **I** increase range of pH unqualified / increasing at extremities.

(c)	1. on pH; 2. range of temperatures; 3. control temperature e.g. keep tubes in water bath throughout investigation / same temperature; 4. equilibrate tubes in different water baths for 5 mins – way of achieving temperature before starting; 5. same volume / concentration of hydrogen peroxide; 6. same enzyme source or concentration / same size or type or mass of filter paper; 7. same size of tubing / apparatus / test tube; 8. repeats / find average; 9. volume of oxygen measured / plot a graph of activity; 10. safety features: includes use forceps to handle pieces of paper / goggles / gloves / lab coat / AW; [MAX 6]	any pH to show control. **A** High to Low / different temperatures / at least 3 / cold & warm & hot. **A** area / amount of filter paper **I** clean or sterilised apparatus
	[Total: 16]	