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**BIOLOGY**

**0610/61**

Paper 6 Alternative to Practical

**October/November 2017**

MARK SCHEME

Maximum Mark: 40

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of **8** printed pages.

**Mark schemes will use these abbreviations**

- ; separates marking points
- / alternatives
- I ignore
- R reject
- A accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording (where responses vary more than usual)
- AVP any valid point
- ecf credit a correct statement / calculation that follows a previous wrong response or reverse argument
- ora
- ( ) the word / phrase in brackets is not required, but sets the context
- underline actual word given must be used by candidate (grammatical variants excepted)
- max indicates the maximum number of marks that can be given

Question	Answer	Marks	Guidance																																	
1(a)(i)	<p>one table drawn with appropriate number of columns ;</p> <p>correct column and row headings with appropriate units (pH and intensity / minutes) ;</p> <p>pH recorded for each solution ;</p> <p>colour of apple slices recorded by intensity for 0 and 10 minutes (numerical values not words) ;</p> <p>colour of apple slices recorded by intensity for 20 minutes (numerical values not words) ;</p>	<b>5</b>	<p><b>I</b> control if added to table</p> <p><b>R</b> if units in data cell</p> <p><b>I</b> units in data cells</p> <p><b>A</b> if the correct data is not linked to a time</p> <p>e.g.</p> <table border="1"> <thead> <tr> <th rowspan="2">(solution)</th> <th rowspan="2">pH</th> <th colspan="3">(colour) intensity (at time) / minutes</th> </tr> <tr> <th>0</th> <th>10</th> <th>20</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>7</td> <td>1</td> <td>2</td> <td>2</td> </tr> <tr> <td><b>B</b></td> <td>2</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td><b>C</b></td> <td>3</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td><b>D</b></td> <td>8</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td><b>E</b></td> <td>9</td> <td>1</td> <td>2</td> <td>3</td> </tr> </tbody> </table>	(solution)	pH	(colour) intensity (at time) / minutes			0	10	20	<b>A</b>	7	1	2	2	<b>B</b>	2	1	1	1	<b>C</b>	3	1	1	1	<b>D</b>	8	1	2	3	<b>E</b>	9	1	2	3
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1(a)(ii)	2 and / or 3, 7, then 8 and / or 9 ;	<b>1</b>	<b>A B</b> and <b>C</b> in either order, <b>A, D</b> and <b>E</b> in either order																																	

Question	Answer	Marks	Guidance										
1(a)(iii)	to compare (what happens to the apple) with the solution and with no solution / at different pH values and no pH / with different pH values and the air / with the solution and with the air ;	1	I for comparison unqualified  A to see what happens to the crushed apple when it is not exposed to the solution A to observe what would happen without the effect of pH A idea that: the control shows that the liquid (or change in pH) is causing the results (and not the air)										
1(a)(iv)	lemon juice ;  has low pH / is acidic / (lemon juice has a pH of 2 and) previous experiment showed that apple won't go brown at pH2 ;	2	A olive oil as keeps out air / oxygen for 2 marks. Olive oil or lemon juice with wrong explanation = 1 mark. Accept enzyme doesn't work (denatured) at pH2										
1(b)(i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;"><i>variable</i></th> <th style="text-align: center;"><i>controlled by</i></th> </tr> </thead> <tbody> <tr> <td>volume / amount / mass, of solution / named solution / liquid</td> <td>adding 20 cm<sup>3</sup></td> </tr> <tr> <td>(same / one) apple</td> <td>all slices cut from the same apple</td> </tr> <tr> <td>time soaking in solution</td> <td>all soaked for 2 mins</td> </tr> <tr> <td>observation time / time intervals</td> <td>left for 20 min / results checked every 10 minutes</td> </tr> </tbody> </table> ; ;	<i>variable</i>	<i>controlled by</i>	volume / amount / mass, of solution / named solution / liquid	adding 20 cm <sup>3</sup>	(same / one) apple	all slices cut from the same apple	time soaking in solution	all soaked for 2 mins	observation time / time intervals	left for 20 min / results checked every 10 minutes	2	one mark for the variable, one mark for method of controlling which must related  I temperature    I time unqualified unless explanation clarifies  A time apple was left in the Petri dish A oxygen / air exposure time
<i>variable</i>	<i>controlled by</i>												
volume / amount / mass, of solution / named solution / liquid	adding 20 cm <sup>3</sup>												
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1(b)(ii)	oxygen is needed (from the air) for the reaction ;	1	A to expose the apple to oxygen I air										
1(b)(iii)	using / cutting (with a knife or scalpel) <b>and</b> cutting away from the hand / cutting on a surface ;	1	I wearing gloves / supervision / blunt knives A cutting carefully / using a slicer / AW										

Question	Answer	Marks	Guidance												
1(c)	any 1 from: idea that it is a qualitative / subjective, method / judged by eye / similar browning looks the same / AW ;	1	<b>A</b> there are more than three shades of brown												
1(d)	<p><i>any pair from</i></p> <table border="1"> <thead> <tr> <th><i>error</i></th> <th><i>improvement</i></th> </tr> </thead> <tbody> <tr> <td>amount of apple not the same / cutting inaccurate</td> <td>use same mass / weight / use a set volume of crushed apple</td> </tr> <tr> <td>crushing uneven</td> <td>use a blender / mortar and pestle</td> </tr> <tr> <td>idea some may have more time in solution than others</td> <td>test each separately</td> </tr> <tr> <td>some apple exposed to air while others being crushed</td> <td>test each separately</td> </tr> <tr> <td>only one slice of apple per solution</td> <td>have at least two more replicates</td> </tr> </tbody> </table> <p style="text-align: center;">; ;</p>	<i>error</i>	<i>improvement</i>	amount of apple not the same / cutting inaccurate	use same mass / weight / use a set volume of crushed apple	crushing uneven	use a blender / mortar and pestle	idea some may have more time in solution than others	test each separately	some apple exposed to air while others being crushed	test each separately	only one slice of apple per solution	have at least two more replicates	2	<b>A</b> (cut to the same size) by using a cutter / ruler, slicer, cutting instrument / AW
<i>error</i>	<i>improvement</i>														
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Question	Answer	Marks	Guidance
1(e)	<p><b>1</b> ref to using at least three temperatures ;</p> <p><b>2</b> stated temperatures or a description ;</p> <p><b>3</b> method described to maintain temperature(s) ;</p> <p><b>4</b> methodology described e.g. ref to leaving the enzyme and substrate separately to reach a set temperature ;</p> <p><b>5</b> ref to constant pH/experiment carried out at the optimum pH;</p> <p><b>6 and 7</b> <i>controlled variables any two from:</i> same concentration of enzyme / same concentration of substrate / same volume of enzyme / same volume of substrate ;;</p> <p><b>8</b> leaving for 20 minutes / leaving for a set time / check at stated time intervals ;</p> <p><b>9</b> ref to substrate at optimum temperature turning brown first or having the highest colour intensity value ;</p> <p><b>10</b> repeat (at least) twice ;</p> <p><b>11</b> AVP e.g. repeat the investigation at temperatures near the optimum to obtain a more accurate optimum temperature ;</p>	<b>6</b>	<p><b>A</b> ref. to measuring time for brown colour to appear</p> <p><b>A</b> optimum temperature shows the darkest colour</p>

Question	Answer	Marks	Guidance
1(f)(i)	<p><b>A(xes)</b> – labelled with units (time/ minutes and percentage of enzyme activity remaining) ;</p> <p><b>S(cale)</b> – suitable, even scale and data occupies at least half the grid ;</p> <p><b>P(lot)</b> – all points plotted accurately <math>\pm\frac{1}{2}</math> square ;</p> <p><b>L(ines)</b> – each line drawn with a ruler point to point or smoothed line ;</p> <p>Lines labelled or a key shown ;</p>	5	
1(f)(ii)	<p>for both fruits, the enzyme activity decreased as time went on ;</p> <p>the apricot enzyme shows the greatest reduction after 15 minutes ;</p> <p>avocado retains enzyme activity for longer after heating than the apricot ;</p>	1	<b>A</b> apricot enzymes are the most easily destroyed by heat/ denatured faster/ <b>ora</b> ;

Question	Answer	Marks	Guidance
2(a)(i)	<p>red blood cells do not have a nucleus/ white blood cells have a nucleus ;</p> <p>red blood cells, have a light area in the centre/ are biconcave ;</p> <p>there are more red blood cells/ fewer white blood cells ;</p> <p>red blood cells contents not granular AW/ white blood cells contents granular ;</p> <p>red blood cells smaller than phagocytes/ <b>ora</b> ;</p> <p>red blood cells are overlapping/ white blood cells do not overlap ;</p>	2	

Question	Answer	Marks	Guidance															
2(a)(ii)	<p><b>O</b> single clear lines on both cell membranes <u>and</u> no shading in the nucleus ;</p> <p><b>S</b> monocyte larger than 2.5 cm and neutrophil larger than 2cm provided ;</p> <p><b>D1</b> monocyte is larger than the neutrophil ;</p> <p><b>D2</b> neutrophil nucleus has two distinct parts joined by a narrow section, larger part at least twice the size of the smaller part ;</p>	<b>4</b>																
2(b)(i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">type of blood cell</th> <th style="width: 30%;">diameters / mm</th> <th style="width: 40%;">average diameter / mm</th> </tr> </thead> <tbody> <tr> <td rowspan="2">red blood cell</td> <td style="text-align: center;">13±1</td> <td rowspan="2" style="text-align: center;">12.5±1</td> </tr> <tr> <td style="text-align: center;">12±1</td> </tr> <tr> <td rowspan="2">lymphocyte</td> <td style="text-align: center;">12±1</td> <td rowspan="2" style="text-align: center;">11.5±1</td> </tr> <tr> <td style="text-align: center;">11±1</td> </tr> <tr> <td rowspan="2">phagocyte</td> <td style="text-align: center;">22±1</td> <td rowspan="2" style="text-align: center;">20.0±1</td> </tr> <tr> <td style="text-align: center;">18±1</td> </tr> </tbody> </table> <p style="text-align: right;">;;;</p>	type of blood cell	diameters / mm	average diameter / mm	red blood cell	13±1	12.5±1	12±1	lymphocyte	12±1	11.5±1	11±1	phagocyte	22±1	20.0±1	18±1	<b>3</b>	<p>mp1 for header units</p> <p>mp2 for six measurements</p> <p>mp3 for three correct averages from candidates results</p>
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2(b)(ii)	8 or 9 ( μm) ;;;	<b>3</b>	<b>A</b> ecf from <b>2(b)(i)</b>															