

**BIOLOGY**

**9700/51**

Paper 5 Planning, Analysis and Evaluation

**October/November 2017**

**MARK SCHEME**

Maximum Mark: 30

**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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

® IGCSE is a registered trademark.

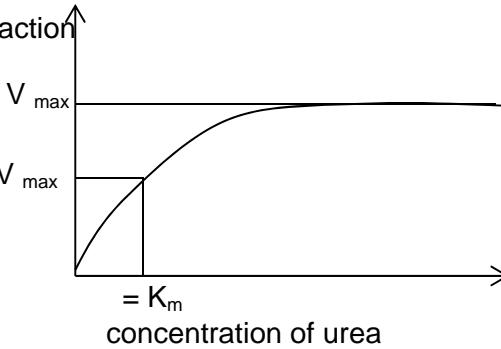
This document consists of **8** printed pages.

**Mark scheme abbreviations**

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point

Question	Answer	Marks
1(a)(i)	weigh / measure (out) / take / put / add / use/ AW, 6 (.01) g urea ; add 500 cm <sup>3</sup> (distilled / deionised) water (and stir until dissolved) ;	2
1(a)(ii)	<i>idea of removing (a known and) same volume of urea solution (with second dilution taken from first dilution, etc.) at each stage of dilution ;</i> <i>idea of adding (a known and) same volume of (distilled) water at each stage of dilution ;</i> <b>A</b> as a diagram showing sequence of dilution <b>A</b> as a table showing volumes (and concentrations) <b>A</b> proportional dilution for max 1 (ecf) if 4 dilutions correctly gained	2
1(b)(i)	<i>independent</i> temperature ; <i>dependent</i> conductivity (of enzyme and substrate / ions / solution) ; <b>A</b> in conductivity units	2
1(b)(ii)	substituting, the active enzyme / urease, by an unreactive substance (at all temperatures) <b>A</b> e.g. boiled or denatured enzyme / water in place of enzyme / 0.0M enzyme / (solution of) urea without urease <b>or</b> substituting, urea / substrate, with water ; <b>I</b> 'use (distilled) water' unqualified <b>A</b> e.g. water in place of substrate / 0.0M substrate / (solution of) urease without urea	1

Question	Answer	Marks
1(b)(iii)	<p><i>max 5 if mp7 not given</i></p> <p><i>any 6 from:</i></p> <p>1 ref. to a suitable range of at least 5 temperatures ; <b>A</b> any 5 in the range 10–70 °C</p> <p>2 ref. to using suitable apparatus (to incubate enzyme and urea solutions at constant temperature(s)) ; e.g. (thermostatically controlled) water baths / incubators / thermostatically or temperature controlled room / (magnetic stirrer) hotplate <b>A</b> beaker plus hot water as water-bath <b>I</b> air conditioning</p> <p>3 ref. to using same volume of urease each time ; <i>total volume must not exceed 30 cm<sup>3</sup></i></p> <p>4 ref. to using same volume of (each) urea concentration ; <i>total volume must not exceed 30 cm<sup>3</sup></i></p> <p>5 ref. to using (same volume of) buffer to maintain a constant pH ; <b>A</b> use buffer to control pH</p> <p><i>procedure:</i></p> <p>6 ref. to incubating urease <b>and</b> urea concentrations separately ;</p> <p>7 ref. to mixing urea and urease solutions (on the magnetic stirrer) <b>and</b> immersing (conductivity) probe ; <b>I</b> 'probe is used' unqualified</p> <p>8 ref. to taking reading (from meter) at same time (for each solution / temperature) ; <b>A</b> any stated time from 0 s to 5 min <b>A</b> take reading immediately / AW <b>A</b> 'use meter to measure rate of reaction' if time context correct</p> <p>9 ref. to testing each of the concentrations (of urea) at each temperature ;</p> <p>10 ref. to a min. of 3 replicates / repeats <b>and</b> a mean / find anomalies ;</p>	6

Question	Answer	Marks
1(b)(iii)	<p>11 ref. to suitable hazard and precaution ;  <b>A</b> low risk experiment  <b>I</b> medium risk experiment  <b>R</b> no risk / high risk  <b>A</b> urease / enzyme is allergen or irritant <b>and</b> wear gloves / goggles  <b>A</b> Ammonia (given off at high temperature) is irritant / mask or gloves</p>	
1(c)(i)	<p>1 one curve drawn correctly ; <i>does not need to go through origin</i>   <b>A</b> straight line up then level without curving</p> <p>2 <math>V_{\max}</math> shown ;      rate of reaction</p> <p>3 <math>\frac{1}{2}V_{\max}</math> shown ;      <math>\frac{1}{2}V_{\max}</math></p>  <p><math>= K_m</math></p> <p>4 <math>K_m</math> shown ; <b>A</b> Michaelis-Menten (constant)</p>	4
1(c)(ii)	<p>1 <b>D</b> ;</p> <p>2 (temperature showing) lowest <math>K_m</math></p> <p><b>or</b></p> <p>shows, greater / greatest / higher / highest, affinity (of the, enzyme / urease) for its substrate / AW ;</p>	2

Question	Answer	Marks
2(a)(i)	<p><i>any 1 from:</i></p> <p>1 time of soaking (grain in the salt solutions) / 12 hours soaking for each set / AW ;</p> <p>2 number of grains (soaked in each, salt concentration / set / covered petri dish) ;</p> <p>3 temperature (of germination / incubation) ; 20 °C <i>if quoted</i></p> <p>4 time intervals of recording (germination) ; A recorded at 8 hour intervals <b>or</b> recorded over 5 days</p> <p>5 <i>idea of taking a standard appearance of grain when judged to be germinated ; e.g. emergence of radicle</i></p>	1
2(a)(ii)	<p><i>any 1 from:</i></p> <p>1 volume of (salt) solution used, on the filter paper / in the (Petri) dish ; I 'amount' unqualified</p> <p>2 age of grain ;</p> <p>3 (use) undamaged / not infected / not diseased / AW, grain ; I size / mass, of grain</p> <p>4 <i>idea of light (exposure of grains during germination / breaking dormancy) ;</i></p> <p>5 supply of, air / oxygen (to the grain) ;</p> <p>6 <i>idea of spacing of grains ;</i></p> <p>7 pH (of solution) ;</p>	1

Question	Answer					Marks																																																						
2(b)(i)	<table border="1"> <thead> <tr> <th rowspan="3">concentration of salt solution /mmol dm<sup>-3</sup></th><th colspan="5">mean (cumulative) percentage of grains that had germinated each day</th></tr> <tr> <th colspan="2">1</th><th colspan="3">5</th></tr> <tr> <th>X</th><th>Y</th><th>X</th><th>Y</th><th></th></tr> </thead> <tbody> <tr> <td>0</td><td>93.8</td><td>92.0</td><td>98.0</td><td>97.0</td><td></td></tr> <tr> <td>10</td><td>93.0</td><td>90.2</td><td>97.4</td><td>96.4</td><td></td></tr> <tr> <td>20</td><td>92.2</td><td>87.0 ;</td><td>96.6</td><td>93.6</td><td></td></tr> <tr> <td>30</td><td>96.4 ;</td><td>90.0</td><td>96.4</td><td>93.0</td><td></td></tr> <tr> <td>40</td><td>92.0</td><td>90.4</td><td>95.4</td><td>92.4</td><td></td></tr> <tr> <td>50</td><td>91.3</td><td>91.0</td><td>95.0</td><td>91.6</td><td></td></tr> <tr> <td>60</td><td>91.2</td><td>90.0</td><td>95.0</td><td>91.0</td><td></td></tr> </tbody> </table>	concentration of salt solution /mmol dm <sup>-3</sup>	mean (cumulative) percentage of grains that had germinated each day					1		5			X	Y	X	Y		0	93.8	92.0	98.0	97.0		10	93.0	90.2	97.4	96.4		20	92.2	87.0 ;	96.6	93.6		30	96.4 ;	90.0	96.4	93.0		40	92.0	90.4	95.4	92.4		50	91.3	91.0	95.0	91.6		60	91.2	90.0	95.0	91.0		2
concentration of salt solution /mmol dm <sup>-3</sup>	mean (cumulative) percentage of grains that had germinated each day																																																											
	1		5																																																									
	X	Y	X	Y																																																								
0	93.8	92.0	98.0	97.0																																																								
10	93.0	90.2	97.4	96.4																																																								
20	92.2	87.0 ;	96.6	93.6																																																								
30	96.4 ;	90.0	96.4	93.0																																																								
40	92.0	90.4	95.4	92.4																																																								
50	91.3	91.0	95.0	91.6																																																								
60	91.2	90.0	95.0	91.0																																																								
2(b)(ii)	<p>1 Pearson's linear correlation ;  <b>A</b> Pearson's      <b>R</b> Pearson's Rank correlation</p> <p>2 data collected is continuous  <b>or</b> data, is / seems to be, (from a population that is) normally distributed  <b>or</b> data / results, appears to be linear ;</p>	2																																																										

Question	Answer	Marks
2(c)	<p><i>I</i> data quotes unqualified any 3 from:</p> <p>1 <i>idea that</i> (germination is rapid because) nearly all / approx. 90% / majority / most, of grains, germinated during the first day ;</p> <p>2 <i>idea that</i> (control shows) some of the barley, will not germinate, over the period of the experiment / in the first five days ;</p> <p>3 percentage germination (generally), decreases as concentration of salt increases / increases as concentration of salt decreases ;  <b>A</b> <i>idea of negative correlation</i></p> <p>4 more grains have germinated after 5 days (than after 1 day) / ora ;</p>	3
2(d)(i)	<p><i>must be comparative</i> <i>I</i> data quotes unqualified</p> <p>germination of barley is, higher / highest, in <b>X</b> (than <b>Y</b> at, all salt concentrations / every value / stated value(s) from 30 mmol dm<sup>-3</sup> to 60 mmol dm<sup>-3</sup>) ;</p>	1
2(d)(ii)	<p><i>any 1 from:</i></p> <p>1 <i>idea of measuring / recording / investigating / AW, germination of, <b>X</b> and <b>Y</b> / both, in salty <u>soil</u> ;</i></p> <p>2 <i>idea of measuring / recording / investigating / AW, growth of, <b>X</b> and <b>Y</b> / both, in salty <u>soil</u> ;</i></p> <p>3 <i>idea of measuring / recording / investigating / AW, yield of, <b>X</b> and <b>Y</b> / both, in salty <u>soil</u> ;</i></p> <p>4 AVP ; e.g. a field investigation involving a transect across an area from low to high salt then measuring abundance of the types along the transect</p>	1