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**Cambridge International Advanced Subsidiary and Advanced Level**

# MARK SCHEME for the May/June 2015 series

## 9700 BIOLOGY

**9700/52** Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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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Mark scheme abbreviations:

| | |
|---|---|
| **;** | separates marking points |
| **/** | alternatives answers for the same point |
| **R** | reject |
| **A** | accept (for answers correctly cued by the question, or extra guidance) |
| **AW** | alternative wording (where responses vary more than usual) |
| **underline** | 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 |
| **ecf** | error carried forward |
| **I** | ignore |

**mp** marking point (with relevant number)

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| 1 (a) | *independent*: <u>concentration</u> of amylase / enzyme ;<br><br>*dependent:* diameter / area of brown zone ; | **I** amount **R** (amylase) extract<br><br>**A** radius of brown zone<br>**A** starch free / digested starch / clear zone<br>**A** area of brown zone minus well<br>**R** blue zone | [2] |
| (b) | any 8 from:<br>*independent variable*<br>1 ref. to method of diluting the 0.5 g dm$^{-3}$ amylase / stock amylase solution<br>**and**<br>to give a minimum of **5** dilutions ;<br><br>2 ref. to concentrations from 0.5 g dm$^{-3}$ downwards with correct units ;<br><br>3 use of a <u>control</u> with example ;<br><br>*dependent variable*<br>4 ref. to a suitable method of measuring diameters / width / radius / area of brown zones ; | 1 0.0 and 0.5 g dm$^{-3}$ can be included in the number of dilutions<br>**A** serial / series / simple / proportional / dilution as method<br>**OR** a description. Use the formula $C_1V_1 = C_2V_2$ to make…<br>**A** If the fungal extract is diluted instead of amylase but **R** mp5<br><br>2 minimum of 3 other stated values between 0.5 g dm$^{-3}$ and 0.0 g dm$^{-3}$<br>must correspond to dilution method chosen<br>**ecf** if no method given<br>**A** 10 fold or a 50% reduction serial dilution<br><br>3 **A** water / 0.0 g dm$^{-3}$ / boiled or denatured extract / enzyme<br><br>4 e.g. using (suitable) ruler / callipers / string and ruler<br>**R** metre ruler<br>**I** graticules<br>**OR** use a (transparent) grid / graph paper **and** count the number of squares<br>**OR** take a photograph and measure using one the methods for finding area<br>**NOTE**: method of measuring must match what they have stated they are measuring. | |

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| | | | |
|---|---|---|---|
| | 5 ref. to testing the (fungal) extract / fungal amylase / fungal enzyme ; | 5 **R** if dilute the fungal extract | |
| | 6 plot a calibration curve of known concentrations **and** use it to determine extract concentration ; | 6 **A** compare extract result with results of known concentrations to identify extract concentration **OR** find approx. range of concentration and then do more at smaller intervals to identify extract concentration | |
| | *standardising variables (max. 3)*<br>7 ref. to suitable stated volume / same volume of amylase (in each well) ; | 7 If a volume is stated – max 1 $cm^3$<br>**I** amount / known | |
| | 8 leave (all plates) for same period of time ; | 8 if time stated, minimum 30 min / max 24 hours | |
| | 9 method of maintaining at same / constant / optimum / stated temperature ; | 9 e.g. incubator / constant temp. room<br>**A** water bath<br>if temp. stated, any **single** temp. in range 15–65 °C<br>**I** air conditioning | |
| | 10 use a buffer to keep the pH of the agar same ; | 10 e.g. making or adding buffer to agar or starch (solutions) A adding buffer to the amylase solution before using it<br>**A** if stated, any single pH | |
| | 11 same concentration of starch (in the agar plates) ; | 11 **I** ref. to other nutrients in agar,<br>**I** amount | |
| | 12 same depth / volume of agar in Petri dish ;<br>13 cover to prevent contamination / evaporation ; | 12 **A** depth of agar plate<br>**I** mass of agar / depth of wells | |
| | *safety*<br>14 ref. to low risk investigation / hazard and suitable safety precaution ; | 14 fungal / enzyme allergy or fungus / enzyme / iodine / agar is irritant and wearing gloves / eye protection / mask<br>**I** iodine as an allergen<br>**R** no risk | |
| | *reliability*<br>15 ref. to a minimum of three replicates and calculate a mean or identify / eliminate / remove anomalies ; | 15 **A** original and 2 more / several / many / multiple<br>**A** outliers for anomalies **R** reduce anomalies | [max 8] |

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| | | | |
|---|---|---|---|
| **(c)** | use a (glucose) biosensor / glucose dipstick or test-strip / named test strip, e.g. clinistix / uristix ;<br><br>(because) γ-amylase will produce glucose **only** / β-amylase will produce maltose (mainly) ; | **A** use Benedict's test **and**<br>**EITHER** weigh precipitate<br>**OR** use colorimeter to find the intensity of blue solution left<br>**OR** time the first appearance of a colour change<br><br>**A** chromatography and stain (to show sugars)<br><br>**A** Barfoed's test for monosaccharides<br><br>**I** *idea that* γ-amylase produces more glucose than β-amylase **R** ora | [2] |
| **(d) (i)** | 1963 shown on extract **B**, plate 5 ;<br><br>1809 shown on extract **D**, plate 3 ; | | [2] |
| **(ii)** | reject / eliminate / ignore / leave out (affected data from calculations) ; | **A** repeat until consistent results obtained<br>**I** repeat unqualified<br>**OR** repeat to find a mean | [1] |

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**(iii)**

correct values for $\Sigma x$ =1820

**and** $\bar{x} = 303 / 303.3 / 303.3^{\bullet}$

**and** $(x-\bar{x})^2$ ;

| $(x-\bar{x})^2$ allowed | 341 | 341.3 | 341.34 | 341.4 | 342 |
|---|---|---|---|---|---|
| $(x-\bar{x})^2$ not allowed | 341.32 | 341.2 | | | |

correct value of ***s*** from table ;

| correct values of ***s*** (±) | 8.(0) | 8.26 | 8.27 | 8.3 |
|---|---|---|---|---|

e.g.

| $\Sigma$ | **1820** | | **342** |
|---|---|---|---|
| $\bar{x}$ | **303** | | |

allow ecf for ***s*** from wrong value of $\sum (x-\bar{x})^2$

[max 2]

**(iv)**

any 3 from:

1 the larger / AW the brown area the more amylase / more enzyme activity ora

**OR** the larger / AW the brown area the more gene copies ;ora

2 (person or extract) **A** had the highest / AW concentration of amylase / (person or extract) **F** has lowest AW concentration of amylase ;

3 (person) **A** has the highest number of gene copies / (person) **F** has the lowest number of gene copies ;

4 ref. to genetic variation in population (for the production of amylase) ;

*Ignore ref. to proportionality / positive correlation between enzyme concentration and gene copies*

**A** strongest / largest / most /
ora weakest / smallest / least
**A** A>B>C>D>E>F
**I** copying results without any conclusion about rank order

[3]

**Total:** **[20]**

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| | | | |
|---|---|---|---|
| **2 (a)** | any 3 from:<br>*variation in volunteers*<br><br>1 body mass / weight ;<br><br>2 ref. to use of drugs e.g. medication / self-inflicted ;<br><br>3 alcohol consumption ;<br><br>4 smoking status ;<br><br>5 ref. to ethnicity ;<br><br>6 volunteer all have the same 'handedness' ;<br><br>7 no medical / named medical condition affecting nerve conduction ;<br><br>*variation in method of applying test*<br>8 same arm tested ;<br><br>9 idea of volunteer not moving (during the test) ;<br><br>10 electrical charge / coulombs / voltage / potential difference ;<br><br>11 same number of volunteers in each age category ; | ***Mark the first three given.***<br>***I*** *environmental factors, e.g. temperature / light / noise in room / time of day*<br>***I*** *diet*<br>***I*** *ref. to distance between or position of electrodes / time of charge application*<br><br>7 e.g. Multiple Sclerosis(MS), Myalgic Encephalitis(ME), Muscular Dystrophy(MD), Motor Neurone Disease (MND),spinal bifida, polio<br>**A** disease of the nervous system<br><br>9 e.g. at rest / sitting / lying down<br><br>10 **A** electrical stimulus<br>**I** current | [max 3] |

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<table>
<tr>
<td>(b)</td>
<td>
<table>
<tr><td rowspan="2">age / years</td><td rowspan="2">mean conduction velocity ± $S_M$</td><td colspan="2">confidence limits</td></tr>
<tr><td>lower limit</td><td>upper limit</td></tr>
<tr><td>60–69</td><td>52.2 ± 0.675</td><td><u>50.85</u></td><td><u>53.55</u> ;</td></tr>
</table>
</td>
<td>note: must have both numbers correct for one mark</td>
<td>[1]</td>
</tr>
<tr>
<td>(c) (i)</td>
<td>30–39 and 70–79<br><br>OR 40–49 and 70–79<br><br>OR 50–59 and 70–79 ;<br><br>there is no overlap of (confidence) limits / $S_M$ ;</td>
<td>A descriptions, e.g. upper limit of 70–79 does not reach lower limit of 30–39<br>I error bars overlapping / range(bars) not overlapping<br>I ref. to mean conduction velocity</td>
<td>[2]</td>
</tr>
<tr>
<td>(ii)</td>
<td>test: t test ;<br><br>reason: comparing (two) <u>means</u> / normal distribution / continuous data ;</td>
<td>R continuous variation</td>
<td>[2]</td>
</tr>
<tr>
<td>(iii)</td>
<td>there is no <u>significant</u> difference between the (mean) conduction velocities / NCV of (individuals from) different age groups ;</td>
<td>needs to be clear that the significant difference is in the conduction velocity and the not the ages<br>A the difference in (mean) conduction velocities of individuals from different age groups is not <u>significant</u><br><br>A stated age categories / women of different ages / young(er) and old(er) women / with age</td>
<td>1</td>
</tr>
<tr>
<td>(d)</td>
<td>large sample size /number of people tested ;</td>
<td>A tested 394 individuals / many people / lots of people ;<br>I sufficient / enough people tested<br>I number of different age categories / ref. to standard error</td>
<td>[1]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total:</td>
<td>[10]</td>
</tr>
</table>

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