Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

**BIOLOGY** **9700/51**

Paper 5 Planning, Analysis and Evaluation **October/November 2016**

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 will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 1(a)(i) | *independent:* concentration of potassium chloride / KC*l* **;**<br><br>*dependent:* number of stomata open / closed **;** | **2** | **A** different concentrations of potassium chloride<br><br>**A** number open and closed |
| 1(a)(ii) | *three from:*<br><br>correct volumes of water and KC*l* solution for making all four dilutions with units **;;**<br><br>method of measuring volumes **;**<br><br>*ref. to* stirring / mixing **;** | **3** | **A** *volumes either in descriptions or a table*<br><br>*max 1 for correct volumes making 1, 2 or 3 dilutions* |
| 1(b)(i) | *idea of:*<br>the higher the concentration of (potassium chloride / KC*l*) the greater the number of stomata open / **ora**<br>**or**<br>the higher the concentration of (potassium chloride / KC*l*) the lower the number of stomata open / **ora**<br>**or**<br>the number of open stomata is directly proportional / inversely proportional to the concentration of potassium chloride / **ora ;** | **1** | ***R*** *in terms of degree / speed of opening and closing of stomata e.g. more* KC*l* *the stomata are wider.*<br><br>**A** a null hypothesis: |

| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 1(b)(ii) | *five from:*<br>1 *ref. to* putting the strips into (all KC*l*) solutions in appropriate containers **;**<br>2 *ref. to* keeping in the dark (when in solution) **;**<br>3 *ref. to* mounting on a slide **and** using a (light) microscope (to count / observe the number of stomata) **;**<br>4 *ref. to* count / record the number of stomata that are open or closed **;**<br>5 *ref. to* a method standardising the counting open / closed stomata **;**<br>6 *ref. to* making several counts on each leaf strip **and** taking a mean / to identify anomalies **;**<br>*control variables max 2 (7–9)*<br>7 *ref. to* using suitable equipment for cutting **and** measuring strips (of same length and width / size / area) **;**<br>8 *ref. to* a method of maintaining a constant temperature **;**<br>9 covering to prevent evaporation **;**<br>10 *one of:*<br>*ref. to* low risk **;**<br>examples of hazard and precaution **;** | **5** | e.g. beakers, watch glasses, Petri dishes<br>**R** test-tubes / boiling tubes / cavity slides<br>**R** electron / electronic microscope / hand lens / magnifying glass<br>e.g. out of the same fixed number of stomata<br>**or** in field of view (at the same magnification)<br>**A** a minimum of 3 counts on one strip<br>**I** *ref. to* repeating whole experiment three times<br>**R** metre rule<br>**A** incubator / temperature controlled room / water-bath if appropriate to apparatus<br>**R** no risk |

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>1(c)(i)</td><td>ref. to using (eyepiece) graticule to measure (the aperture) ;<br><br>one from<br>calibrating the (eyepiece) graticule with a (stage) micrometer AW ;<br>convert / calibrate the eye piece units to μm / mm ;</td><td>2</td><td>R if use graticule and stage micrometer to measure<br><br>A ref. to converting eyepiece units using conversion / calibration factor</td></tr>
<tr><td>1(c)(ii)</td><td>two (for one mark) from<br><br>
<table>
<tr><td>time / min</td><td colspan="16">stomatal aperture / μm</td></tr>
<tr><td>0</td><td>0.5</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.4</td><td>0.1</td><td>0.5</td><td>0.2</td><td>0.3</td><td>0.3</td><td>0.1</td><td>0.2</td><td>0.2</td><td>0.2</td><td>0.4</td></tr>
<tr><td>60</td><td>0.9</td><td>1.1</td><td>1.0</td><td>1.3</td><td>1.2</td><td>1.8</td><td>1.5</td><td>0.8</td><td>0.2</td><td>1.3</td><td>1.1</td><td>0.8</td><td>1.0</td><td>1.9</td><td>0.9</td></tr>
<tr><td>120</td><td>1.9</td><td>2.4</td><td>2.6</td><td>2.6</td><td>2.5</td><td>2.2</td><td>2.8</td><td>2.4</td><td>2.4</td><td>3.9</td><td>2.6</td><td>2.3</td><td>2.5</td><td>2.2</td><td>2.7</td></tr>
<tr><td>180</td><td>4.1</td><td>4.8</td><td>4.2</td><td>4.0</td><td>5.7</td><td>4.7</td><td>3.9</td><td>4.1</td><td>5.5</td><td>4.5</td><td>4.3</td><td>4.0</td><td>3.1</td><td>4.1</td><td>4.3</td></tr>
</table>
</td><td>1</td><td></td></tr>
<tr><td>1(c)(iii)</td><td><u>0.035</u> ;</td><td>1</td><td></td></tr>
</table>

| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 1(c)(iv) | *three from*<br>measure more stomata / all the stomata (per epidermal strip) **;**<br><br>select stomata to be measured randomly **;**<br><br>use more leaves / epidermal strips **;**<br><br>measure at shorter (time) intervals / more frequently **;** | **3** | *if specify a number, should be 10 or more*<br><br>**R** use different types of plant |
| 1(d) | *idea that* the longer the time of light exposure the wider stomata open / the wider the aperture **;** | **1** | **R** *idea of* different light intensity |
| | **Total:** | **19** | |

| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 2(a) | *two (for one mark) from*<br><br>number of fields studied **;**<br>(width of) the headland / strip **;**<br>(type of) cereal / crop **;** | **1** | **A** length *if qualified by 6 m* |
| 2(b)(i) | data is nominal / categoric<br>**or**<br>testing the difference between observed (O) and expected (E) results **;** | **1** | **A** data can be grouped / is discrete |
| 2(b)(ii) | there is no <u>significant difference</u> between number of butterflies of each species when headland sprayed and when not sprayed **;** | **1** | **A** without herbicide / not treated / control *for not sprayed*<br>**A** with herbicide / treated *for sprayed* |

| Question | Answer | Mark | Additional Guidance |
|---|---|---|---|
| 2(b)(iii) | <table><tr><th>species **Q**</th><th>O</th><th>E</th><th>$(O-E)^2$</th><th>$\frac{(O-E)^2}{E}$</th></tr><tr><td>number on headland sprayed with herbicide</td><td>3</td><td>20</td><td>289</td><td>14.45 ;</td></tr><tr><td>number on headland not sprayed with herbicide</td><td>37</td><td>20</td><td>289</td><td>14.45 ;</td></tr></table> $\chi^2 = 28.9$ ; | **3** | *if E is correct, but one row is processed incorrectly, allow ecf for correct addition to obtain* $\chi^2$ *value*<br>*max 2* |
| 2(b)(iv) | 3.84 ; | **1** | |
| 2(b)(v) | significant (at $p < 0.001$) / herbicide is causing the number of butterflies to decrease ; | **1** | **ecf** *from errors in* ***(iii)*** *and / or* ***(iv)*** |
| 2(c) | *three from*<br>1 *idea that* where herbicide has been used there are fewer / smaller population of all species investigated ;<br>2 *idea of* (decrease / difference) in species **S** is only one that is not significant / **ora** ;<br>3 herbicide has greatest effect on the population of **R** (and **Q**) ;<br>4 *ref. to* the sequence of the severity of the effect of the herbicide ;<br>5 probability of the results being due to chance is less than 5% for all species except **S** (and **Q**) ; | **3** | sequence is (**R** >) V / W > T / U > S<br>*if* ***R*** *included in the sequence allow mp3 and mp4*<br>**A** probability of the result being due to herbicide is more than 95% for all species except **S** |
| | **Total:** | **11** | |