

# Mark Scheme (RESULTS)

## January 2008

GCE

GCE Biology (6103/02)

Question Number	Answer	Mark																												
1 (a)	<table border="1"> <thead> <tr> <th>Time of day</th> <th>Cushion temp. / °C</th> <th>Mean cushion temp. / °C</th> <th>Air temp. / °C</th> </tr> </thead> <tbody> <tr> <td>08.00</td> <td>8,9,8</td> <td>8.3 (8.33)</td> <td>4</td> </tr> <tr> <td>10.00</td> <td>17,15,15</td> <td>15.7 (15.67)</td> <td>7</td> </tr> <tr> <td>12.00</td> <td>20,22,23</td> <td>21.7(21.67)</td> <td>9</td> </tr> <tr> <td>14.00</td> <td>21,21,22</td> <td>21.3 (21.33)</td> <td>11</td> </tr> <tr> <td>16.00</td> <td>19,17,20</td> <td>18.7 (18.67)</td> <td>9</td> </tr> <tr> <td>18.00</td> <td>6,5,5</td> <td>5.3 (5.33)</td> <td>3</td> </tr> </tbody> </table> <p>suitable table with time, mean cushion temp and air temp ;</p> <p>correct rows and columns with headings and units ;</p> <p>means correct to consistent sig. figs. (all correct = 2 marks, one error = 1 mark);;</p>	Time of day	Cushion temp. / °C	Mean cushion temp. / °C	Air temp. / °C	08.00	8,9,8	8.3 (8.33)	4	10.00	17,15,15	15.7 (15.67)	7	12.00	20,22,23	21.7(21.67)	9	14.00	21,21,22	21.3 (21.33)	11	16.00	19,17,20	18.7 (18.67)	9	18.00	6,5,5	5.3 (5.33)	3	max 4
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1 (b)	<p>F line graph format with both lines on same axes ;</p> <p>A axes correct orientation and labelled with suitable scale ;</p> <p>P points plotted correctly ;</p> <p>L straight line joins points or good curve through all points ;</p>	4

Question Number	Answer	Mark
1 (c)	<ol style="list-style-type: none"> <li>cushion temperature always above air temperature ;</li> <li>as air temperature increases <b>AND</b> decreases so cushion temp increases <b>AND</b> decreases ;</li> <li>some relevant use of figures e.g. maximum cushion temp. 10.3 °C higher than maximum air temp. ;</li> <li>temp / max cushion temp. almost double max air temp. / eq ;</li> </ol>	max 2

Question Number	Answer	Mark
1 (d)	<ol style="list-style-type: none"> <li>1. no evidence of any significant anomalies / cushion temp. falls even though air temp. continues to rise ;</li> <li>2. random cushion readings do not vary by more than 3<sup>0</sup>C / cushion air temp. anomaly quantified ;</li> </ol>	2

Question Number	Answer	Mark
1 (e)	<ol style="list-style-type: none"> <li>1. reference to higher temperature promoting metabolism (e.g. enzyme activity, photosynthesis) ;</li> <li>2. growing points / meristems can be protected from temperature extremes inside cushion ;</li> <li>3. ref to reduction in surface area / eq ;</li> </ol>	max 2

Question Number	Answer	Mark
2 (a)	<p>Points 1 &amp; 2: reference to initial seeds/seedlings at start of study</p> <p>Points 3 &amp; 4: extraction of root nodules material (from established plants)</p> <p>Points 5 &amp; 6: selection of seedlings for inoculation</p> <p>Points 7 to 13: design, growth parameters and measurement</p> <ol style="list-style-type: none"> <li>1. use of stated leguminous plant / member of <i>Papilionaceae</i> for study (e.g. clover) ;</li> <li>2. {germinate / grow} {seeds / seedlings} in two named standard conditions ;</li> <li>3. remove nodules (from established plant of same species) ;</li> <li>4. suitable method of extraction of constant concentration of inoculum (e.g. {grind / eq} stated mass of root nodules in stated volume of water) ;</li> <li>5. stated number (5 or more) of {seedlings / seeds} for each trial ;</li> <li>6. seedlings / eq / seeds {same size / same mass / measured parameter} at start ;</li> <li>7. preparation of concentrations described (e.g. named nitrogen source / nitrate / ammonium salt / fertiliser e.g. 1 g in 100 cm<sup>3</sup>) ;</li> <li>8. same volume of nitrogen source (in every case) ;</li> <li>9. 5 or more concentrations of nitrogen source used ;</li> <li>10. suitable (control) with no nitrogen added (e.g. using distilled water) ;</li> <li>11. seedlings grown for stated period (minimum 1 week) ;</li> <li>12. {count number / obtain {wet / dry} mass of root nodules} ;</li> <li>13. minimum of 2 repeats (i.e. three trials in total) ;</li> </ol>	<p style="text-align: right;">max 9</p>

Question Number	Answer	Mark
2 (b)	<ol style="list-style-type: none"> <li>1. suitable table of raw data, with correctly labelled rows and columns, including units to match the method ;</li> <li>2. line graph / bar chart ;</li> <li>3. correctly orientated and labelled axes including units ;</li> <li>4. calculation of means ;</li> </ol>	max 3

Question Number	Answer	Mark
2 (c)	<p>Limitations: <span style="float: right;">[Sub-maximum 4]</span></p> <ol style="list-style-type: none"> <li>1. difficult to know if (original nodules / extract) contain living bacteria;</li> <li>2. difficult to know if {seeds / growth medium} already contain <i>Rhizobium</i> ;</li> <li>3. difficult to get {seeds / seedlings} {to take up bacteria to develop nodules} ;</li> <li>4. environmental conditions inhibit {formation of nodules (if not controlled) / enzymes (of <i>Rhizobium</i>)} ;</li> <li>5. difficult to collect / count all root nodules ;</li> </ol> <p>Further work: <span style="float: right;">[Sub-maximum 4]</span></p> <ol style="list-style-type: none"> <li>6. the effects of root nodules / leguminous plants on the growth of crop plants per se ;</li> <li>7. test effect of different concentrations of inoculant ;</li> <li>8. the effects of different species of legume <u>and</u> fertiliser on plant growth / crop production ;</li> <li>9. the effect of root nodules and types of fertiliser on the growth of other legumes / eq ;</li> <li>10. a named environmental condition on root nodule formation ;</li> <li>11. undertaking field trials into the relationship between <i>Rhizobium</i>, fertilisers and crop production ;</li> </ol>	max 6