**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2013 series

## 9700 BIOLOGY

**9700/53** 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.

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.

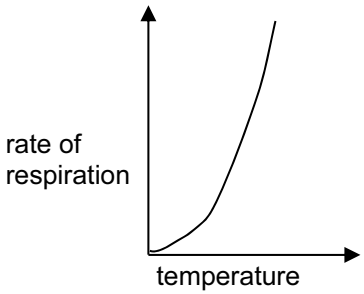
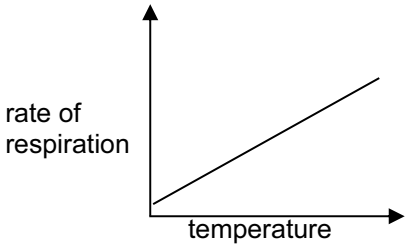
Cambridge is publishing the mark schemes for the October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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Mark schemes abbreviations:

| | |
|---|---|
| **;** | separates marking points |
| **/** | alternatives answers for the same point |
| **R** | reject |
| **A** | accept (for answers correctly cued by the question, or guidance for examiners) |
| **I** | ignore (for responses that are irrelevant to the answer given) |
| **AW** | alternative wording (where responses vary more than usual) |
| **underline** | actual word given must be used by candidate (grammatical variants excepted) |
| **max** | indicates the maximum number of marks that can be given |
| **ora** | or reverse argument |
| **ecf** | error carried forward |
| **mp** | marking point (with relevant number) |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| 1 (a) (i) | *independent:* temperature ;<br>*dependent:* distance moved by, dye / air (along capillary / AW, in a specific time); | **I** volume of oxygen taken in / rate of respiration<br>**A** distance moved / movement of, dye / air | [2] |
| (ii) | axes correct orientation and labelled ;<br>line, exponential / increases with temperature;<br><br> | units not required<br>**A** for *y*-axis, volume of oxygen / amount of oxygen / oxygen uptake / distance moved / distance along capillary / movement of dye or air<br>line does not need to start at origin<br>if axes not labelled assume they are correct way round and award plot mark if possible<br>if axes inverted, look for appropriate curve | [2] |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| (iii) | *8 of:*<br>*independent variable:*<br>1. use, same mass / known (stated) mass, of (germinating) <u>seeds</u> ; | 1. **I** amount. **A** stated number of seeds but ignore 1 seed<br>**R** organisms / named organisms other than seeds | |
| | 2. ref. to suitable number and range of temperatures ; | 2. minimum of 4 temperatures giving minimum of three 10°C rises | |
| | *dependent variable* :<br>3. ref. to method of measuring distance moved ; | 3. e.g. use a ruler or grid on tube / mark start and end and use a ruler / use a graduated tube / callipers<br>**R** metre rule if first on list | |
| | 4. ref. to measurements of distance at, specific / known / stated, time intervals ; | mp3 and mp4 can be stated as same distance and measure time or same time and measure distance either time or distance must be fixed<br>**A** any specified time | |
| | 5. ref. to some idea of a method of placing dye into capillary **or**<br>ref. to use of syringe to, set / reset, dye ;<br>*controlled variables (max 3)* | 5. **A** pull dye into capillary / dye sucked in / idea of dropping pipette to insert dye / tube dipped into dye | |
| | 6. ref. to ensuring apparatus is airtight / method described ; | 6. **I** watertight<br>**A** vaseline / plasticine / tight connections / AW, as method | |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| | 7. ref. to method of keeping constant temperature ; | 7 e.g. in water bath / incubator / temp controlled room<br>**I** air conditioning<br>**R** ref. to thermometers if used to control temperature<br>**A** thermostatically controlled device | |
| | 8. *idea of:* equilibration / acclimatisation / AW, of respirometer containing seeds before measuring ; | 8. **I** stated times - looking for acclimatisation / AW<br>**A** 'to get a steady rate' | |
| | 9. *idea of:* replacing, air / oxygen, between measurements ; | 9. **A** refresh air at intervals | |
| | 10. ref. to control / comparison, with inert material (of same mass) ; | 10. e.g. glass beads / boiled seeds / stones / AW | |
| | 11. ref. to using, same / stated, mass of absorbent **or** replacing, each time / from time to time / when saturated / AW ; | 11. **A** *idea of* enough absorbent to ensure all carbon dioxide absorbed / excess absorbent.<br>**I** amount / volume **A** same number of pellets | |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| | *safety:*<br>12. ref. to suitable hazard and precaution ; | 12. **A** carbon dioxide absorbent being, corrosive / an irritant / harmful / toxic / poisonous / AW, **and** gloves / eye protection / AW<br>**A** ref. to allergic risk from seeds or absorbent **and** precaution (gloves / mask / AW)<br>**A** 70 °C or above water and suitable handling like tongs<br>**A** low risk **R** no risk | |
| | *reliability*:<br>13. ref. to replicates, and mean / to identify or eliminate anomalies ; | 13. must be a minimum of 3<br>**A** as original and 2 more / several<br>**A** repeats<br>**A** average for mean<br>**A** outliers for anomalies<br><br>**I** mean of readings along the capillary at timed intervals i.e. mean of distances measured 1–2 min, 2–3 min, 3–4 min | [max 8] |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| **(b)** | *allow answers that describe the main stages of the calculation in words or as a formula*<br><br>*look for the elements of the calculation which may be shown separately*<br><br>*3 of:*<br>1. ref. to valid method calculating volume of oxygen ;<br><br>2. ref. to dividing by the mass ;<br><br>3. ref. to dividing by time ;<br><br>4. ref. to correct units either $\underline{cm^3\,g^{-1}}\ \underline{s^{-1}}$ or $\underline{cm^3\,g^{-1}}\ \underline{min^{-1}}$ ;<br><br>**or**<br><br>ref. to valid method calculating volume of oxygen ;<br><br>$\frac{\text{total volume of oxygen } (cm^3)}{\text{total time (s) x mass (g)}}$ (= y) ; ;<br><br>(y )= $\underline{cm^3\,s^{-1}\,g^{-1}}$ or $\underline{cm^3\,g^{-1}}\ \underline{min^{-1}}$ ; | 1. **A** any valid method, e.g. distance (d) / length (l) / height (h) × $\pi\, r^2$ / $\pi\,(D \div 2)^2$ / $D^2 \div 4$, pre- calibrated tube.<br>d / l / h do not need to be explained.<br>**I** surface area × d / l / h<br><br>4. **A** $cm^3$ / g / s **or** $cm^3$ / g / min<br><br>**I** actual value of y if an example is used<br>**A** $cm^3$ / g / s **or** $cm^3$ / g / min **or** per in words | [max 3] |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| **(c)** | *2 of:*<br>1. idea of finding <u>range</u> at which the, oxygen uptake / dye movement / respiration rate, was greatest ;<br><br>2. ref. to repeating the measurements (in this range) at smaller temperature intervals ;<br><br>3. one with max, oxygen uptake / dye movement / respiration rate = optimum temperature ; | 2. **A** do smaller intervals across whole range<br><br>3. **A** in context of plotting a graph to find optimum<br>**A** general ref. to do at various temps and find one with highest value | [max 2] |
| **(d) (i)** | *idea that:*<br>(most / all, of) the results are, higher / larger (than those measured at the same temperature in the other trials) ; | **A** results, furthest from / large distance from / AW, means<br>**A** some results are significantly higher<br>**R** does not follow the trend of others / trend different but **A** same trend but higher<br>**I** just quoting one or two temps are out, e.g 20<br>**I** ref. to standard deviation | [1] |
| **(ii)** | *1 of:*<br>*idea that* mammal, moving around / more energetic / not at rest / has higher metabolic rate ;<br><br>mammal, under stress / frightened / shocked / nervous / AW ;<br>*idea of* have not given enough time for the mammal to adapt to the apparatus ; | **I** ref. to faulty, apparatus / technique<br><br>**A** different, gender / size / species / type, of mammal, (in, each trial / first trial)<br>**A** idea of food intake before (first) trial<br>**I** contaminated with microorganisms<br><br>**A** mammal not, acclimatised / accustomed / used / AW, to conditions | [max 1] |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| (iii) | *2 of :*<br>1. higher oxygen uptake means, higher rate of / more, respiration ; ora<br><br>2. (at, lower temperatures / this temperature,) mammal is losing more heat (to the environment) / AW ;<br><br>3. ref. to (at lower temperatures) mammal is respiring more / using more oxygen, to, release more heat / maintain (body) temperature / keep (body) temperature constant ; | **A** metabolism / ATP production, as alternative terms for respiration<br>**A** thermal energy for heat<br>**I** energy unqualified<br><br>1. look for a link between the higher uptake and higher rate.<br>not just 'needs more oxygen to respire'<br><br>2. **A** faster temperature drop / looses heat more easily / AW<br><br>3. **Ignore** ref. to keeping warm | [max 2] |
| | | | **[Total: 21]** |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| 2 (a) (i) | *1 of:*<br>temperature ;<br><br>light <u>intensity</u> ;<br><br>concentration of (radioactive) auxin ;<br><br>composition / type, of the agar ; | mark first in list but<br>**I** amount throughout<br>**I** light unqualified<br><br><br>**A** mass / weight **R** volume<br><br>**A** same agar / same concentration of agar | [max 1] |
| (ii) | *1 of:*<br>oxygen / air, is required for the movement of auxin ;<br><br>energy / ATP / respiration, is required for the movement of auxin ;<br>movement of auxin involves active transport ; | **A** in terms of 'most movement'<br>**A** *idea that* movement is, greater / faster / better / more / AW, in, air / oxygen (than in nitrogen) ora but must mention air / oxygen<br>**I** 'air is an opt medium for movement'<br>**I** 'rate of movement is affected by surrounding air / atmosphere'<br>**I** ref. to N being inhibitory / AW | [max 1] |
| (iii) | 50 (mm $h^{-1}$) ; | **R** if units wrong<br>**A** mm/h **or** mm per hour | [1] |

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| Question | Expected answer | Extra guidance | Mark |
|---|---|---|---|
| **(b) (i)** | mean in dark is lower / mean rate in dark is slower ; ora<br><br>no overlap in terms of using the values for ***s*** / confidence intervals ; | **A** idea that lower rates overall for plants grown in the dark ora<br>**A** raw figures<br>**I** ref. to standard deviation being lower<br>**I** ref. to error bars | [2] |
| **(ii)** | *idea of:*<br>there is no <u>significant</u> difference in the rate of movement (of auxin) for, plants grown in light and (plants grown) in dark / the 2 treatments; | **A** the difference in the rate of movement (of auxin) for plants grown in light and plants grown in dark is not significant<br>**I** differences in movement in light and dark are due to chance. | [1] |
| **(iii)** | *3 of:*<br>1. general idea of, finding / using, degrees of freedom<br><br>2. ref. to using 0.05 / 5% <u>probability</u> to find critical value / AW (for *t*) ;<br><br>3. idea of: compare the (calculated) *t* –value with the critical value / AW ;<br><br>4. if value of *t* is higher than critical value it is significant / not due to chance) / reject null hypothesis / accept alternative hypothesis ; ora | 1. **A** using 18 degrees of freedom ;<br>**I** any wrong number calculated and award mark if degrees of freedom cited<br>**I** any formula e.g. (10 –1) +( 10–1)<br><br>2. **A** 0.01 / 1% probability<br>**A** significance levels for probability<br><br>3. **A** see if value of *t* is, higher / lower, than critical value<br>**A** if refer to 'the right or left of the critical value' or 'above or below'.<br>**A** for mp2 and mp3 alternatives to critical value, e.g.'table value / chart value / the value looked up'<br><br>4. **I** ref. to 'insignificant' / 'more significant' / 'less significant' | [3] |
| | | | **[Total: 9]** |

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