Cambridge International AS & A Level

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**BIOLOGY** **9700/42**

Paper 1 A Level Structured Questions **October/November 2016**

MARK SCHEME

Maximum Mark: 100

**Published**

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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) |
| **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 |
| **mp** | marking point (with relevant number) |
| **ecf** | error carried forward |
| **I** | ignore |

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| Question | Answer | Mark |
|---|---|---|
| 1(a) | *three from*<br>1 *ref. to* enzyme / phosphorylase / signalling **;**<br>2 *ref. to* aquaporins **;**<br>3 vesicles (containing aquaporins), move towards / fuse with, (cell surface membrane) **;**<br>4 *idea of* increased permeability **;**<br>5 water leaves (lumen into cells), by osmosis / down water potential gradient **;** | **3** |
| 1(b)(i) | allele / gene, carried on the X chromosome **; A** sex chromosome | **1** |
| 1(b)(ii) | *symbols*<br>normal allele = A<br>DI allele = a **;**<br><br>*parental genotypes*<br>$\mathbf{X^AX^a \times X^AY}$<br>**and**<br>*gametes*<br>$\mathbf{X^A \quad X^a \quad X^A \quad Y}$ **;**<br><br>*offspring genotypes*<br>$\mathbf{X^AX^A \quad X^AY \quad X^AX^a \quad X^aY}$ **;**<br><br>*offspring phenotypes*<br>female normal male normal female normal male DI **;**<br>*in correct order* | **4** |
| | **Total:** | **8** |

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| Question | Answer | Mark |
|---|---|---|
| 2(a) | *two from*<br>1 first product of photosynthesis is a 4-carbon compound **;**<br>2 oxaloacetate / malate / aspartate **;**<br>3 (first) $CO_2$ acceptor PEP **;**<br>4 $CO_2$ released (from 4-carbon compound to) enter Calvin cycle / light-independent stage **;** | **2** |
| 2(b)(i) | *two from*<br>1 rate in C4 grasses higher (than C3 grasses) **; ora**<br>2 mean rate in C4 3.17 a.u. **and** mean rate in C3 1.65 a.u.**;**<br>3 more variation between C4 plants (than between C3 plants) **; ora** | **2** |
| 2(b)(ii) | *three from*<br>1 fixation of carbon (dioxide) **;**<br>2 (catalyses) the reaction between RuBP and $CO_2$ / AW **;**<br>3 to give **two** GP **;**<br>4 via an unstable intermediate compound **;** | **3** |
| 2(b)(iii) | 1 PEP carboxylase has higher rate of activity in C4 plants **; ora**<br>2 *idea that* C4 plants can live in high, temperature / light intensities **or** C4 plants have more PEP **;**<br>3 rubisco has higher rate of activity in C3 plants (than in C4 plants) **;**<br>4 (due to) higher concentration of $CO_2$ **;** | **4** |

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| Question | Answer | Mark |
|---|---|---|
| 2(c) | *two from*<br>1 C4 plants are adapted for high, light intensities / temperatures **;**<br>2 (so) high rate of, photophosphorylation / light-dependent reaction **;**<br>3 (so) much ATP produced **;** | **2** |
| | **Total:** | **13** |

| Question | Answer | Mark |
|---|---|---|
| 3(a)(i) | *two from*<br>1 to, separate the two strands / denature DNA **;** **A** make single-stranded DNA<br>2 by breaking hydrogen bonds (between bases) **;**<br>3 so that bases are exposed **;**<br>4 to produce template strands for (complementary) copying **;** | **2** |
| 3(a)(ii) | *two from*<br>1 (primer) binds / anneals, to DNA by complementary base pairing **;**<br>2 *idea of* attaching close to the specific section of DNA **;**<br>3 (DNA) polymerase only attaches to double-stranded DNA **;**<br>4 (primers) reduce re-annealing of separated strands **;** | **2** |

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| Question | Answer | Mark |
|---|---|---|
| 3(a)(iii) | *two from*<br>1 synthesises complementary DNA strands **;**<br><br>2 (*Taq* polymerase), is heat stable / works at high temperature **;**<br><br>3 (so) does not need to be added again for each cycle / needs replacing only after a number of cycles **;**<br>**or**<br>other polymerases need replacing regularly **;**<br><br>4 process is, more efficient / faster (than normal DNA polymerase) **;** | **2** |
| 3(b)(i) | many mitochondria per cell but only one nucleus **;**<br><br>cell, is diploid / has two copies of each chromosome (in nucleus) **;** | **2** |
| 3(b)(ii) | **A**, **C**, **D**, **E**, **F ;** | **1** |
| | **Total:** | **9** |

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| Question | Answer | Mark |
|---|---|---|
| 4(a) | *three from*<br>1 (overall) deltamethrin, more effective / better, (at killing mosquitoes) **;**<br><br>2 figures for malathion and deltamethrin with named site and year **R** Jamnagar in 2007<br>**or** mean 78.5% for malathion and 97.5% for deltamethrin **;**<br><br>3 malathion, kills higher percentage (of mosquitoes) / is more effective,<br>than deltamethrin in Jamnagar in 2007 **;**<br><br>4 percentage of mosquitoes killed by deltamethrin decreasing in Jamnagar **;**<br><br>5 percentage of mosquitoes killed by malathion increasing (in both locations) **;** | **3** |
| 4(b) | *four from*<br>1 (random) mutation / genetic variation **; A** description of mutation<br><br>2 deltamethrin acts as a selection pressure **;**<br><br>3 resistant mosquitoes have selective advantage **; ora**<br><br>4 resistant mosquitoes, survive / reproduce **; ora**<br><br>5 resistance alleles passed on **;**<br><br>6 increase in frequency of resistance allele **; ora**<br><br>7 natural / directional, selection **;** | **4** |
| 4(c) | *two from*<br>1 percentage of mosquitoes killed (by malathion) increases **;**<br><br>2 (malathion) selection pressure removed / resistance to malathion is no longer a selective advantage **;** | **2** |

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| Question | Answer | Mark |
|---|---|---|
| | 3 *idea of* resistance not needed **;** | |
| 4(d) | discontinuous **;** | **1** |
| 4(e) | p = 0.13 **; ; ;**<br><br>*allow max 2 for working*<br>$q^2$ / frequency of non-resistant (mosquitoes) = 0.76<br><br>q = 0.87 | **3** |
| | **Total:** | **13** |

| Question | Answer | Mark |
|---|---|---|
| 5(a)(i) | ecosystem is, a defined area / self-contained / a functional unit **;**<br><br>*idea that* Italy consists of multiple, towns and agricultural fields / water bodies / forests **;** | **2** |
| 5(a)(ii) | *four from*<br>1 increase in variety of, habitats / ecosystems **;**<br><br>2 increase number of species / more complex food web **;**<br><br>3 increase abundance of organisms within a species **;**<br><br>4 increase in genetic variation **;**<br><br>5 *ref. to* succession **;** | **4** |

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| Question | Answer | Mark |
|---|---|---|
| 5(b) | *four from*<br>1 education / awareness, programmes **;**<br>2 compensation scheme / incentives, (needed for farmers who have livestock preyed upon) **;**<br>3 ban, hunting / poaching **;**<br>4 *ref. to* population monitoring **;**<br>5 international / cross-border, agreement / laws **;**<br>6 *ref. to* WWF / CITES / trade agreements **;**<br>7 *ref. to* zoos / reserves / national parks **;**<br>8 captive breeding / sperm banks **;** | **4** |
| | **Total:** | **10** |

| Question | Answer | Mark |
|---|---|---|
| 6(a)(i) | high concentration of oestrogen (causes surge in LH concentration)<br>**or**<br>(surge in LH concentration) causes ovulation to occur **;** | **1** |
| 6(a)(ii) | progesterone concentration falls (towards end of cycle) **;** | **1** |

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| Question | Answer | Mark |
|---|---|---|
| 6(b)(i) | *four from*<br>1 (acts on) anterior pituitary gland ;<br>2 FSH secretion inhibited ; **I** FSH inhibited<br>3 Graafian / dominant, follicle does not develop ;<br>4 LH secretion inhibited ; **I** LH inhibited<br>5 ovulation prevented / AW ;<br>6 *ref. to* negative feedback ;<br>7 cervical mucus thickens ;<br>8 *ref. to* thin endometrium ; | **4** |
| 6(b)(ii) | to allow menstruation to occur / *idea of* mimicking the body's natural cycle ; | **1** |
| 6(b)(iii) | *one from*<br>1 no need to take contraceptive pill every day **;**<br>2 maintains steady concentration of hormones / no hormonal imbalance **;**<br>3 AVP **;** e.g. no menstruation / fewer side effects | **1** |
| | **Total:** | **8** |

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| Question | Answer | Mark |
|---|---|---|
| 7(a)(i) | **A** – pointing to thin filament areas **;**<br><br>**B** – pointing to overlapping areas **;** | **2** |
| 7(a)(ii) | *four from*<br>1 $Ca^{2+}$ channels open in, pre-synaptic membrane / (pre)-synaptic knob / motor end plate **;**<br><br>2 $Ca^{2+}$ enter, pre-synaptic knob / pre-synaptic neurone / motor end plate **;**<br><br>3 vesicles contain, neurotransmitter / ACh **;**<br><br>4 (vesicles) move towards / fuse, with <u>pre-synaptic membrane</u> **;**<br><br>5 (ACh / neurotransmitter) released / exocytosis, **and** <u>diffuses</u> (across cleft) **;**<br><br>6 6. binds to receptors on sarcolemma **; A** post-synaptic membrane<br><br>7 $Na^{+}$ channels open **and** $Na^{+}$ enters, (muscle fibre / sarcoplasm) **; R** sarcolemma | **4** |

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| Question | Answer | Mark |
|---|---|---|
| 7(b) | | 4 |

| correct order | letter of event |
|---|---|
| 1 | **S** |
| 2 | **V** |
| 3 | **Q** |
| 4 | **U** |
| 5 | **Z** |
| 6 | **Y** |
| 7 | **W** |
| 8 | **R** |
| 9 | **X** |
| 10 | **T** |

**S**, **V**, **Q**, **U** all above **Z ;**
**S**, **V**, **Q**, **U** in correct order **;**

**Y**, **W**, **R**, **X** between **Z** and **T ;**
**Y**, **W**, **R**, **X** in correct order **;**

| | | |
|---|---|---|
| | **Total:** | **10** |

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| Question | Answer | Mark |
|---|---|---|
| 8(a) | gibberellin **;** | **1** |
| 8(b)(i) | absorbs carbon dioxide **;** | **1** |
| 8(b)(ii) | *three from*<br>1 used in, oxidative phosphorylation / ETC **;**<br>2 final electron acceptor **;**<br>3 proton acceptor **;**<br>4 forms water **;**<br>5 allows ETC to continue **;**<br>6 *ref. to* ATP produced **;** | **3** |
| 8(c)(i) | equilibration / acclimatising / adjusting **;** | **1** |

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| Question | Answer | Mark |
|---|---|---|
| 8(c)(ii) | *two from*<br>1 act as a control **;**<br><br>2 *idea of* control eliminates effects of variables other than, the independent variable / temperature **;**<br><br>3 (changes in **A** and **C** are) due to, seeds / respiration **; ora** | **2** |
| 8(c)(iii) | 0.087 **; ;**<br><br>*allow one mark for*<br>$\frac{1.7-0.4}{15}$ $\frac{1.3}{15}$ $\frac{1.3}{20-5}$ $\frac{1.7-0.4}{20-5}$<br>**or**<br>0.08666 | **2** |
| 8(c)(iv) | *at 25°C (**ora** for 10°C)*<br>*two from*<br>1 increased kinetic energy **;**<br><br>2 enzymes involved **;**<br><br>3 *idea of* more ESCs **;** | **2** |
| 8(c)(v) | enzymes denatured **;**<br><br>detail **;** e.g. change in active site (shape) / H bonds break | **2** |
| | **Total:** | **14** |

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| Question | Answer | Mark |
|---|---|---|
| 9(a) | *seven from*<br>1 *ref. to* maintenance of constant internal environment **;**<br>2 blood or tissue fluid as e.g. of internal environment **;**<br>3 *ref. to* norm / optimum value / set point / within narrow limits **;**<br>4 (low) temperature **and** consequence **;** e.g. slowed metabolism / enzymes less active<br>5 (high) temperature **and** consequence **;** e.g. enzymes denatured<br>6 (low) water potential **and** consequence **;** e.g. water leaving cells / cells shrink<br>7 (high) water potential **and** consequence **;** e.g. water enters cells / cells burst<br>8 (low) blood glucose **and** consequence **;** e.g. effect on respiration<br>9 (high) blood glucose **and** consequence **;** e.g. water leaving cells / cells shrink<br>10 AVP **;** e.g. control of pH and consequence | **7** |

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| Question | Answer | Mark |
|---|---|---|
| 9(b) | *eight from*<br>1 adrenaline binds to receptors **;**<br>2 in, cell surface membrane / plasma membrane **;**<br>3 receptor changes conformation **;**<br>4 G proteins activated **;**<br>5 adenylyl cyclase activated **; A** adenyl cyclase<br>6 cyclic AMP / cAMP, made **;**<br>7 second messenger **;**<br>8 activates kinase (protein) **;**<br>9 *ref. to* enzyme cascade / signal amplification **;**<br>10 *ref. to* phosphorylase **;**<br>11 glycogen broken to glucose / glycogenolysis **;**<br>12 glucose diffuses, out of cells / into blood **;**<br>13 increase in blood glucose concentration **;** | **8** |
| | **Total** | **15** |

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| Question | Answer | Mark |
|---|---|---|
| 10(a) | *seven from*<br>1 acid-growth (hypothesis) **;**<br>2 auxin stimulates proton pumps **;**<br>3 (in) cell surface membrane **;**<br>4 $H^+$ pumped into cell wall **;**<br>5 using energy / by active transport **;**<br>6 pH of cell wall decreases / cell wall becomes (more) acidic **;**<br>7 pH-dependent enzymes activated **;**<br>8 *ref. to* expansins **;**<br>9 bonds between cellulose microfibrils broken **;**<br>10 *idea that* cell wall, 'loosens' / becomes more elastic / able to stretch **;**<br>11 (more) water enters cell / turgor pressure increases **;**<br>12 (so) cell (wall) expands **;** | **7** |

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| Question | Answer | Mark |
|---|---|---|
| 10(b) | *eight from*<br>1 plant secretes abscisic acid, in very dry conditions / at times of water stress **;**<br>**A** abscisic acid is a stress hormone<br><br>2 abscisic acid binds to receptors **;**<br><br>3 on cell surface membranes of guard cells **;**<br><br>4 inhibits proton pump / $H^+$ not pumped out of cell **;**<br><br>5 high $H^+$ conc inside cell **; A** *ref. to* change in charge<br><br>6 (abscisic acid) stimulates $Ca^{2+}$ influx **;**<br><br>7 $Ca^{2+}$ acts as second messenger **;**<br><br>8 encourages $K^+$ efflux / inhibits $K^+$ influx **; A** $K^+$ channels open<br><br>9 water potential of cell increases **; A** increase in solute potential<br><br>10 water moves out of cell by osmosis **;**<br><br>11 volume of guard cells decreases **;**<br><br>12 guard cells become flaccid **;**<br><br>13 response very fast **;** | **8** |
| | **Total:** | **15** |

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