Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/41**

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

Question	Answer	Mark
1(a)	*three from* 1 *ref. to* enzyme / phosphorylase / signalling **;** 2 *ref. to* aquaporins **;** 3 vesicles (containing aquaporins), move towards / fuse with, (cell surface membrane) **;** 4 *idea of* increased permeability **;** 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* normal allele = A DI allele = a **;** *parental genotypes* **$X^AX^a \times X^AY$** **and** *gametes* **X^A X^a X^A Y ;** *offspring genotypes* **X^AX^A X^AY X^AX^a X^aY ;** *offspring phenotypes* female normal male normal female normal male DI **;** *in correct order*	**4**
	Total:	**8**

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

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

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

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

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

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

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

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

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

Question	Answer	Mark
6(b)(i)	*four from* 1 (acts on) anterior pituitary gland ; 2 FSH secretion inhibited ; **I** FSH inhibited 3 Graafian / dominant, follicle does not develop ; 4 LH secretion inhibited ; **I** LH inhibited 5 ovulation prevented / AW ; 6 *ref. to* negative feedback ; 7 cervical mucus thickens ; 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* 1 no need to take contraceptive pill every day **;** 2 maintains steady concentration of hormones / no hormonal imbalance **;** 3 AVP **;** e.g. no menstruation / fewer side effects	**1**
	Total:	**8**

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

Question	Answer	Mark
7(b)	(see table and marking points below)	4
	Total:	**10**

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 **;**

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

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

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

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

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

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