Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/43**

Paper 4 A Level Structured Questions **May/June 2020**

MARK SCHEME

Maximum Mark: 100

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	'List rule' guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided • Any response marked *ignore* in the mark scheme should not count towards ***n*** • Incorrect responses should not be awarded credit but will still count towards ***n*** • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Mark scheme abbreviations:

;	separates marking points
/	alternative answers for the same marking point
R	reject
A	accept
I	ignore
AVP	any valid point
AW	alternative wording (where responses vary more than usual)
ecf	error carried forward
underline	actual word underlined must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)(i)</td><td>any two from:

1 (fruits are) yellow and round ;

2 fruits do not resemble either parent ;

3 fruits resemble Floridor (variety) ;</td><td>2</td></tr>
<tr><td>1(a)(ii)</td><td>gametes correctly entered ;

genotypes correctly worked out ;

phenotypes match genotypes ;

ratio of fruit phenotypes 9 yellow round : 3 yellow long : 3 green round : 1 green long ;

<table>
<tr><th></th><th>AB</th><th>Ab</th><th>aB</th><th>ab</th></tr>
<tr><td>AB</td><td>AABB
yellow round</td><td>AABb
yellow round</td><td>AaBB
yellow round</td><td>AaBb
yellow round</td></tr>
<tr><td>Ab</td><td>AABb
yellow round</td><td>AAbb
yellow long</td><td>AaBb
yellow round</td><td>Aabb
yellow long</td></tr>
<tr><td>aB</td><td>AaBB
yellow round</td><td>AaBb
yellow round</td><td>aaBB
green round</td><td>aaBb
green round</td></tr>
<tr><td>ab</td><td>AaBb
yellow round</td><td>Aabb
yellow long</td><td>aaBb
green round</td><td>aabb
green long</td></tr>
</table>
</td><td>4</td></tr>
</table>

Question	Answer	Marks
1(b)	*any **three** from:* 1 meiosis, cannot occur / is disrupted ; 2 33 / odd number of, chromosomes ; 3 three copies of each (homologous) chromosome ; 4 chromosomes cannot (all), pair up / form bivalents / undergo synapsis ; 5 in prophase 1 ; 6 gametes / ovules (pollen), not formed ;	**3**
1(c)(i)	different genera / chromosome numbers different (22 and 40) / offspring would be sterile ;	**1**
1(c)(ii)	*any **two** from:* 1 genetic engineering / genetic modification / recombinant DNA technology ; 2 use restriction, enzyme / endonuclease, to cut *C. ecuadorensis*, genome / DNA ; 3 use, vector / plasmid / *A. tumefaciens* ; 4 to insert WMV-resistance gene into watermelon (cells) ;	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>any two from:
1 uncontrolled mitosis / continuous cell cycle / cell cycle checkpoints not controlled ;
2 abnormal mass of cells formed ;
3 no programmed cell death / no apoptosis / cells immortal ;
4 ref. mutation ;
5 ref. tumour suppressor genes / (proto)oncogenes ;</td><td>2</td></tr>
<tr><td>2(a)(ii)</td><td>any three from:
1 ref. (effect on) neurosecretory cells in hypothalamus ;
2 production / synthesis, of ADH, decreases / stops ;
3 idea of less ADH secreted (into blood) by posterior pituitary ;
4 collecting duct walls less permeable to water ;
5 water remains in collecting duct / most water remains in urine ;</td><td>3</td></tr>
<tr><td>2(b)</td><td><table>
<tr><th>feature</th><th>nervous system</th><th>endocrine system</th></tr>
<tr><td>signal</td><td>impulse</td><td>hormone ;</td></tr>
<tr><td>method of transmission of signal</td><td>neurone / axon ;</td><td>in blood</td></tr>
<tr><td>type of communication</td><td>electrical ;</td><td>chemical</td></tr>
<tr><td>duration of effect</td><td>short term</td><td>long-lasting ;</td></tr>
</table></td><td>4</td></tr>
</table>

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Question	Answer	Marks
3(a)(i)	*any **four** from:* *pre-zygotic* 1 mate preference / sexual selection, based on plumage **;** 2 mate preference / sexual selection, based on song **;** 3 AVP **;** e.g. not, geographic / temporal, as they mate to produce hybrids *post-zygotic* 4 no (normal) sperm in hybrids / all hybrids sterile **;** 5 *idea that* all nests with hybrid male, in male-female pair, were parented by another male (of same species as female) **;** 6 selection against hybrids because of, reproductive failure **;** 7 comparative data quote to support mp4, mp5 or mp6**;**	**4**

Question	Answer	Marks
3(a)(ii)	*any **five** from:* 1 *ref. to* geographical isolation ; 2 no, gene flow / interbreeding, between populations ; 3 different, selection pressures / environmental conditions ; 4 different mutations occur ; 5 some mutations make individuals better adapted ; 6 those individuals, survive / reproduce ; 7 pass on advantageous alleles ; 8 *ref. to* many generations ; 10 reproductive isolation ; 11 allopatric speciation ;	**5**
3(b)(i)	*specific primer* to, select / bind to, the target region (for amplification) ; *restriction enzyme* cut DNA at specific, restriction / recognition, site *or* produces fragments of different lengths ; *gel electrophoresis* separates the fragments into length order ;	**3**

Question	Answer	Marks
3(b)(ii)	1 one fragment versus two fragments ; *any **one** from:* 2 one fragment because no restriction site in target region ; 3 the two species do not share the same SNP ;	**2**
4(a)	*any **two** from:* 1 chloride ions / Cl^-, do not leave / stay inside, epithelial cell ; 2 (so) no, difference of water potential between inside and outside of cells ; 3 no <u>osmosis</u> (of water) out of the cell ;	**2**
4(b)	*any **three** from:* *if test negative* 1 reduces worry (during pregnancy) ; 2 non-CF child will not have to go through the same procedure if they choose to have children ; *if test positive* 3 early, treatment / management of, CF symptoms ; 4 option of, (therapeutic) abortion / termination ; 5 ref. to reducing frequency of CF allele (in the human population) ;	**3**

Question	Answer	Marks
4(c)	*any **three** from:* 1 therapeutic abortion not needed **;** 2 increases probability of successful pregnancy **;** 3 single biopsy less, dangerous / damaging, to embryo (than double biopsy) **;** 4 cheaper as, more successful / higher pregnancy rate **;** 5 preselection / choosing, may be against beliefs **;**	**3**

Question	Answer	Marks
5(a)(i)	*structural gene:* **C ;** *control (regulatory) sequence:* **B ;** *repressor molecule:* **A ;**	**3**
5(a)(ii)	*any **two** from:* 1 is not, made all the time / constitutive **;** 2 gene switched on / protein made, (only) when needed **;** 3 triggered by a, change / stimulus / molecular signal / Msn2 / absence of glucose **;** 4 concentration increases when galactose present **;**	**2**
5(b)(i)	$\frac{226}{806} \times 100$ **;** 28 (%) **;**	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(b)(ii)</td><td>1 (Mig1 in nucleus) low(er) when glucose is absent ; ora
2 (as) Mig1 is not, needed in nucleus / bound to DNA ;</td><td>2</td></tr>
<tr><td>5(c)</td><td>any two from:
lac Z / gene for β-galactosidase ;
lac Y / gene for, lactose permease / β-galactoside permease ;
lac A / gene for β-galactoside transacetylase ;</td><td>2</td></tr>
<tr><td>6(a)</td><td><table><tr><th>description</th><th>letter</th></tr><tr><td>accessory pigment</td><td>D ;</td></tr><tr><td>location of ATP synthase</td><td>A ;</td></tr><tr><td>acts as reaction centre</td><td>C ;</td></tr><tr><td>transports hydrogen atoms</td><td>F ;</td></tr><tr><td>diffuses through ATP synthase</td><td>H ;</td></tr><tr><td>broken down in photolysis</td><td>E ;</td></tr></table></td><td>6</td></tr>
<tr><td>6(b)(i)</td><td>cellulose / starch ;</td><td>1</td></tr>
<tr><td>6(b)(ii)</td><td>nitrogen ;</td><td>1</td></tr>
<tr><td>7(a)(i)</td><td>area A – intermembrane space ;
process B – chemiosmosis / ATP synthesis ;
substance C – oxygen ;</td><td>3</td></tr>
</table>

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Question	Answer	Marks
7(a)(ii)	enzyme / protein / polypeptide ;	1
7(a)(iii)	substrate–linked phosphorylation ;	1
7(b)(i)	22 (÷) 7 ; 3.14 ;	2
7(b)(ii)	*any **two** from:* 1 more red blood cells so more haemoglobin; 2 more haemoglobin to carry oxygen ; 3 more chance of aerobic respiration **or** less chance of anaerobic respiration ;	2
7(c)	*any **two** from:* 1 (relatively) more C–H bonds ; 2 more reduced NAD produced ; 3 more hydrogen atoms to build up proton gradient ; 4 more, chemiosmosis / oxidative phosphorylation ;	2
7(d)(i)	(thermal) insulation ;	1

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Question	Answer	Marks
7(d)(ii)	*any **two** from:* 1 (thermo)receptors in the skin detect change **;** 2 *ref. to* threshold / all or nothing law **;** 3 sensory neurone sends impulse (to hypothalamus) **;**	**2**
7(d)(iii)	*any **two** from:* 1 increased, glycogenolysis / glucose available **;** 2 (so) increased respiration **;** 3 (so) more heat energy generated (and transferred to blood) **;**	**2**

Question	Answer	Marks
8(a)	*any **five** from:* 1 lay out a, line / tape **;** 2 (line / tape) runs from low tide area to high tide area **;** 3 *ref. to* use of quadrats **;** 4 *ref. to* interrupted belt transect **;** 5 place quadrats at regular intervals **;** 6 measure species frequency **;** 7 use of key **or** Braun Blanquet / other named, scale **;** 8 repeat sampling **;**	**5**
8(b)(i)	**B** and **C** **;**	**1**
8(b)(ii)	Pearson's linear correlation / Spearman's Rank **;**	**1**

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Question	Answer	Marks
9(a)	*any **eight** from:* *discontinuous* 1 one / few, genes control a phenotype ; 2 qualitative ; 3 discrete categories / no intermediates ; 4 different alleles at single gene locus have large effect on phenotype ; 5 different genes have different effects ; 6 little / no, contribution by environment to phenotype 7 example ; e.g. albinism / sickle cell anaemia / haemophilia / Huntington's disease *continuous* 8 several genes control a phenotype ; 9 quantitative ; 10 range of categories / many intermediates ; 11 different alleles at single gene locus have small effects ; 12 environment has considerable influence on phenotype ; 13 example ; e.g. height / mass	**8**

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Question	Answer	Marks
9(b)	*any **seven** from:* 1. choose parents with good features ; 2. breed these ; 3. repeat for many generations ; 4. introduction of disease resistance ; 5 named crop disease ; 6 dwarf varieties ; 7 (dwarf varieties) mutant alleles for gibberellin synthesis ; 8 (dwarf varieties) more energy put into grain than into height (of plant) ; 9 (dwarf varieties) less susceptible to being knocked over by weather ; 10 inbreeding leads to uniformity ; 11 named example ; e.g. standard height / cobs ready to harvest at same time 12 hybridisation leads to hybrid vigour ;	**7**

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Question	Answer	Marks
10(a)	*any **eight** from:* 1 mechanical energy converted to electrical ; 2 cell membrane depolarises ; 3 (if at least) two hairs touched (within 35 seconds); 4 action potential occurs ; 5 action potential / depolarisation, spreads over, leaf / lobe ; 6 *ref. to* hinge / midrib, cells ; 7 H^+/ protons, pumped out of cells / pumped into cell walls ; 8 cell wall, loosens / cross-links broken ; 9 calcium pectate dissolves (in middle lamella) ; 10 Ca^{2+} (ions) enter cells ; 11 water enters by osmosis ; 12 cells, expand / become turgid ; 13 change from convex to concave ; 14 trap shuts, quickly / in <1s / in 0.3s ;	**8**

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Question	Answer	Marks
10(b)	*any **seven** from:* 1 maintain constant internal environment ; 2 despite changes in the, internal / external, environment ; 3 changes in, factor / stimulus, detected by receptor ; 4 named factor ; e.g. temperature / water potential / blood glucose concentration 5 impulses to CNS / input ; 6 *ref. to* central control / CNS, decision ; 7 impulses to effector / output ; 8 hormones to target cells 9 named effector ; e.g. muscle / gland 10 corrective action ; 11 factor returns to set point ; 12 negative feedback ; 13 AVP ; e.g. fluctuations around set point	**7**

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