Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 2019**

MARK SCHEME

Maximum Mark: 60

Published

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 International will not enter into discussions about these mark schemes.

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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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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
AVP alternative valid point

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Question	Answer	Marks
1(a)	*any three from:* *secondary structure* **I** α-helix **1** (many) β-pleated / beta-pleated, sheets **;** **R** 'B' **2** random structure / irregular structures / loops / beta turns / AW **;** *tertiary structure* **3** folding / coiling, of, (each) polypeptide chain(s) / secondary structure **;** **R** *idea of* polypeptide chains interacting (quaternary structure) **4** *ref. to* globular **A** description, e.g. spherical **I** circular / round **or** *ref. to* 3D, shape / structure **; A** 3D arrangement	**3**
1(b)(i)	**X** – site of synthesis of, (light and heavy) polypeptides **; A** protein(s) **A** transport / modification, of, polypeptides / proteins **A** assembly of polypeptides / translation **R** answers that name the Golgi body **Y** – production of ATP **;** **R** 'produce / create / AW, energy' **A** release of energy / provide energy	**2**
1(b)(ii)	cell / membrane, fusion / AW **; I** 'mix' (named) fusogen / hybridogen used **;** e.g. polyethylene glycol / electrofusion / electric current **A** PEG for polyethylene glycol (between) plasma cell / (activated) B-lymphocyte / (activated) B-cell / splenocyte, **and**, tumour / cancer / myeloma, cell **;** **R** β cells	**3**

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Question	Answer	Marks
1(b)(iii)	*any three from:* **1** some mAbs act **directly** on target cells / some mAbs work **indirectly** to kill cells / mAbs do not damage other (non-target) cells **;** **2** by binding to, specific / complementary, antigens/cell surface receptors **;** **3** (named), drugs / radioactive isotopes, can be attached to mAbs **;** **A** 'tagged' **I** labelled **4** enzymes can be attached to mAbs **;** **5** so drug can be activated at site of action (linked to mp4) **;** **6** bispecific mAbs attach two cells together **;** **7** *ref. to* interrupting cell signalling **;** **8** use of mAbs for passive immunity **;** **A** described *in context of therapeutic antibody for treatment of disease* **9** stimulating / AW, immune system / phagocytes / macrophages / T-lymphocyes, to kill, cancer cells **;** **10** name of a cancer or autoimmune disease that is treated with mAbs **;**	**3**
2(a)	*any two from:* ('kinks') prevents close packing of, phospholipids / membrane components, (at low temperature) **;** keeps / maintains, fluidity **;** **A** increases **A** ora - prevents becoming too rigid *idea of* preventing damage to membranes by preventing freezing **;** maintains movement of (named) substances across membranes **;** **A** any named example of movement across membrane **R** increases AVP **;** e.g. maintains movement of proteins within membrane	**2**

Question	Answer	Marks
2(b)(i)	*idea that triglycerides and phospholipids* are not composed of, monomers / repeating (sub-)units **;**	**1**
2(b)(ii)	*any two from:* *phospholipids have* two fatty acids (residues / tails) not three **;** **A** hydrocarbon chains / aliphatic chains **A** one less fatty acid (residue / tail) **A** ora two ester bonds rather than three **;** a phosphate (group / head) **; A** ora **R** 'phosphate not glycerol' AVP **;** e.g. may have a (named) additional group, such as choline / AW e.g. triglycerides do not have nitrogen / phospholipids may have nitrogen	**2**
2(c)	*any four from:* **1** thromboxane is a (cell) signalling molecule **;** **A** 'thromboxane acts as a signal' **I** 'messenger' / hormone **2** released into / circulates in / AW, blood / plasma **;** **3** (smooth) muscle, cell / tissue, is <u>target</u> **;** **4** thromboxane binds to <u>receptors</u> **;** **5** *ref. to* thromboxane is complementary to receptor **;** **6** (specific) response is smooth muscle (cell) contraction **;** **R** smooth muscle constricts **7** AVP **;** e.g. detail of change, such as activating G proteins / secondary messenger / enzyme cascade / chain of reactions / AW	**4**

Question	Answer	Marks
3(a)(i)	*any two from:* (Neutrase® breaks down / hydrolyses) protein to, peptides / amino acids / smaller molecules **;** **A** idea of increase in solubility during the reaction / AW, more light passes through / more light is transmitted / less light is absorbed **;** *idea that* 100 s is long enough to see the progress of the reactions **;** **I** 'the rate of reaction can be calculated' **I** 'allow time for reaction to complete'	**2**
3(a)(ii)	*accept **ora** where appropriate* **1** copper sulfate, decreases / AW, the activity of Neutrase (*ref. to* **A** or **B**) **;** **2** 0.01 (mol dm^{-3}) / low concentration, $CuSO_4$ has less of an effect than, 0.05 (mol dm^{-3}) / high concentration (*ref. to* **A** and **B**) **;** **3** potassium sulfate has, little / no, effect on activity (*ref. to* **C**) **;** **4** data quote to show absorbance for two different lines at the same time **;** *one time and two absorbance readings from different lines on the graph with the unit for time used once anywhere in answer, allow 'at the end' for 100 s* **5** copper sulfate is an inhibitor of Neutrase **;** **6** potassium sulfate is not an inhibitor **;** **A** 'less of…' **7** copper sulfate binds to Neutrase **;** **A** anywhere **8** substrate cannot enter active site / ESCs do not form (so protein not hydrolysed) **;** **A** fewer ESCs	

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Question	Answer	Marks
3(b)	*higher productivity / higher yield and fewer costs because* enzyme can be re-used **;** enzyme can be easily recovered **;** downstream processing is easier **;** product, not / less, contaminated **;** **A** less purification needed longer shelf-life of enzyme **;** reduces product inhibition **;** enzyme is, more stable / less likely to denature *or* described **;** **A** thermostable / can work at high temperatures **A** in context of change in pH **I** 'can withstand changes in temperature'	**2**

Question	Answer	Marks
4(a)	*any one from:* *idea that* to provide cells that can, differentiate / divide **;** for (continued) growth of the, shoot tip / (named) tissues **;** **I** 'to produce more meristematic cells'	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(b)</td><td>one mark per row

<table>
<tr><th>stages</th><th>description</th></tr>
<tr><td>F and G</td><td>cell, elongates / enlarges / grows and, a vacuole forms / makes a tonoplast ;</td></tr>
<tr><td>G and H</td><td>cell divides (longitudinally) and one of the cells has a vacuole ;</td></tr>
<tr><td>H and J</td><td>developing sieve tube cell, elongates / enlarges / grows and loses its nucleus
or
one (developing companion) cell divides (transversely) to form (two) companion cells ;

A companion cell divides</td></tr>
</table></td><td>3</td></tr>
<tr><td>4(c)</td><td>any four from:

1 elongated cells to form, long tubes / AW ;

2 little, cytoplasm / cell contents / fewer organelles, to reduce resistance to flow ;
A peripheral cytoplasm / no nucleus, to allow transport of maximum volume of, (named) assimilates / sap / nutrients
A ‘more space for …..’
R no organelles R ‘no cell contents’

3 sieve (plates have) pores, so little barrier to flow from cell to cell / easy (for phloem sap) to pass from cell to cell / allows mass flow ;
4 sieve plates, support / stop collapse of / stop bulging of, sieve tube elements ;
A become plugged with, P-protein / callose, to prevent losses / after damage
A maintain hydrostatic pressure (in sieve tubes)

5 <u>plasmodesmata</u> between sieve tube and companion cell for ease of, loading / unloading / AW ;
6 AVP ; e.g. membrane around sieve tube for osmosis to occur / prevent loss of (named) assimilates</td><td>4</td></tr>
</table>

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Question	Answer	Marks
4(d)	*allow assimilates / AW for sucrose* **1** movement of sucrose from, mesophyll / parenchyma / source, cells **;** **A** movement of sucrose to (named) sink cells **2** move sucrose, into / out of, sieve tubes (through plasmodesmata) **;** **3** pump, protons / hydrogen ions / H^+, out of cell / into cell wall/into apoplast **;** **A** *ref. to* secondary active transport **4** provides, ATP / proteins, for sieve tubes **;** **A** maintain metabolism of sieve tubes	**2**

Question	Answer	Marks
5(a)	*closed* blood flows through, (blood) vessels**;** **A** three of heart, arteries, veins, capillaries *double* blood flows through the heart twice in one complete circulation (of the body) / AW **;** **A** *ref. to* pulmonary and systemic circuits / to lungs and rest of body	**2**
5(b)(i)	pulmonary vein **;** semi-lunar / AW, valve **; A** pulmonary valve **R** aortic valve right, atrium / auricle **;**	**3**

Question	Answer	Marks
5(b)(ii)	*any three from:* **1** left ventricle / chamber **Y**, pumps blood into, systemic circulation / described ***or*** right ventricle / chamber **X** pumps blood into, pulmonary circulation / described ***or*** distance travelled by blood in systemic circulation is greater than distance travelled by blood in pulmonary circulation / AW**;** **2** to overcome great(er) resistance to flow in systemic circulation **; ora** **3** high (blood) pressure is required for blood to travel around the systemic circulation **;** **4** high pressure requires more muscular force **; ora** **5** pulmonary capillaries, rupture easily / damaged by high pressure **;** **I** more cardiac muscle	**3**
5(c)	*any four from:* **1** impulse / wave of excitation / AW, passes from SAN to atria (muscles) **;** **R** nervous impulse / signal *once only* **2** atria both contract, together / at the same time **;** **A** atrial systole *if not contradicted by one contracting before the other* **3** atria contract before ventricles **;** **4** fibrous / non-conducting, tissue prevents impulse travelling to ventricles **;** **5** impulse delayed at AVN **;** **6** AVN passes impulse to, bundle of His / Purkyne fibres **;** **7** Purkyne fibres conduct impulses to <u>muscle</u> in wall of ventricles **;** **8** ventricles contract together (if mp2 not awarded) **;** **A** ventricular systole if not contradicted as for atria **9** ventricles contract from the bottom upwards **;**	**4**

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Question	Answer	Marks
6(a)(i)	30% **;** **A** anywhere in the answer bases, are paired / are complementary **;** **A** with *ref. to* binding **A** hydrogen bonds between, A and T / C and G **A** thymine *or* T pairs with adenine *or* A / cytosine or C pairs with guanine or G calculation / explanation for 30% **;** e.g. A+T = 40%, C+G = 60%, half of 60% = 30%	**3**
6(a)(ii)	mitochondria / mitochondrion (in cytoplasm) **;** **R** whole answer if anything else is first or second in answer **R** 'mitochondria and / or cytoplasm'	**1**
6(b)(i)	G G U C **;**	**1**
6(b)(ii)	anticodon **;** *any two from:* **Q** / anticodon, binds / AW, to, <u>codon on mRNA</u> **;** **I** *ref. to* complementary bases alone *idea that* specificity ensures correct primary structure (of polypeptide / protein) **;** **A** correct amino acid sequence (of polypeptide / protein)	**3**
6(b)(iii)	site of attachment of (specific) amino acid (to tRNA) / amino acid binding site **;**	**1**

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