Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **March 2020**

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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This document consists of **13** printed pages.

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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.

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.

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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.

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.

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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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Question	Answer	Marks
1(a)	**(F)** **C** **E** **D** **A** **B** ; ; ; ; all five correct = four marks three or four correct = three marks two correct = two marks one correct = one mark	**4**
1(b)	1 water, leaves sieve tube (element) / follows sucrose **;** *any **two** from:* 2 down the water potential gradient / from higher to lower water potential / by osmosis / sucrose (in companion cell in sink) lowers water potential **;** **A** ψ *for water potential* 3 decreases volume in sieve tubes (in sink) **;** 4 decreases (hydrostatic) pressure (in sieve tubes in sink) **;** 5 pressure higher (in sieve tube) at source than pressure (in sieve tube) at sink / (maintains) pressure gradient from source to sink / sap moves down pressure gradient **;**	**3**

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Question	Answer	Marks
2(a)	*any **two** from:* *PAP2, because* activity is shown at 0.0 mmol dm^{-3} / does not require Mg^{2+} for activity ; (at 0.0 mmol dm^{-3}) 30 arbitrary units activity ; no / very little, change at all concentrations of Mg^{2+} ;	**2**
2(b)	**A** substrate for phosphatidate throughout **A** enzyme for PAP throughout *any **four** from:* 1 increasing concentration of phosphatidate increases PAP activity ; 2 at higher phosphatidate concentrations the increase in PAP activity is less steep ; 3 data to support marking point 1 or 2 ; 4 phosphatidate (concentration) is limiting factor / enzyme concentration begins to be limiting at higher concentrations (of phosphatidate) ; 5 at low phosphatidate concentrations, not all (enzyme) active sites are occupied / active sites are available or more active sites occupied at higher concentrations / AW ; **R** all active sites saturated (at higher concentrations)	**4**
2(c)(i)	*any **two** from:* (fatty acid tails are long) hydrocarbon chains / many C-H bonds ; ref. to dense packing / large mass per unit volume ; AVP ; e.g. qualified ref. to role of hydrogens (in oxidative phosphorylation) bond energy released when bonds are broken ;	**2**

Question	Answer	Marks
2(c)(ii)	*any **two** from:* hydrophilic / polar, (phosphate) head and, hydrophobic / non-polar, (fatty acid) tails **;** (so) heads face, watery environment / tissue fluid / cytoplasm / cytosol / aqueous environment **;** (so) tails, form hydrophobic core / form area away from water / face each other **;** **A** ref. to tails and hydrophobic interactions	**2**

Question	Answer	Marks
3(a)	superior vena cava and inferior vena cava **;** **A** venae cavae **A** vena cava	**1**
3(b)	*any **four** from:* 1 pressure in ventricles decreases (in context of relaxation) **;** 2 semilunar valves close **;** 3 atria filling with blood / blood entering atria 4 bicuspid and tricuspid / left and right atrioventricular, valves open **;** **A** mitral *for bicuspid* 5 blood enters ventricles (passively) **;** allow once only (either marking point 5 or 8) 6 atria contract / atrial systole **;** 7 pressure in atria exceeds pressure in ventricles **;** 8 (so) blood enters ventricles (from atria) **;** allow once only (either marking point 5 or 8) 9 AVP **;** e.g. ref. to heart sounds (from valve closure)	**4**
3(c)(i)	**P** C T C **;** **Q** G T G **;** **R** G U G **;**	**3**
3(c)(ii)	β-globin / beta globin **;**	**1**

Question	Answer	Marks
3(d)	*any **three** from:* *in terms of sickle cell:* 1 low(er) affinity for oxygen / low(er) carrying ability of haemoglobin for oxygen / (more) difficult for oxygen to bind to haemoglobin / AW **;** *uptake:* 2 lower uptake of oxygen / lower saturation of haemoglobin (at same partial pressures) **;** *release* 3 oxygen is more easily released (at same partial pressures) **;** 4 AVP **;** e.g. requires higher partial pressure of oxygen to reach same level of saturation ref. to structure of abnormal haemoglobin, e.g. sticky fibres reduced allosteric effect of haemoglobin molecule for uptake ref. to allosteric release of oxygen in respiring tissues ref. to sketch curve on graph and numerical comparison increase in, 2,3-BPG / 2,3-DPG	**3**

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Question	Answer	Marks
4(a)	*trachea and bronchus (max 1):* C-shaped cartilage rings in trachea vs, irregular / plates of, cartilage in bronchus **;** more mucous glands in trachea / fewer mucous glands in bronchus **;** pseudostratified / description, epithelium in trachea vs columnar epithelium in bronchus **;** *bronchus and bronchiole (max 1):* cartilage in bronchus **or** no cartilage in bronchiole **;** many goblet cells in bronchus vs few or no goblet cells in bronchiole / more goblet cells in bronchus / fewer goblet cells in bronchiole **;** mucous glands in bronchus **or** no mucous glands in bronchiole **;** more smooth muscle in bronchus / less smooth muscle in bronchiole **;** *bronchiole and alveolus (max 1):* ciliated epithelium / ciliated cells / cilia / columnar epithelium / cuboidal epithelium, in bronchiole **or** squamous / pavement, epithelial cells in alveolus **;** thick wall / wall of several layers, in bronchiole, vs, thin / single layered, wall in alveolus **;** smooth muscle in bronchiole **or** no smooth muscle in alveolus **;**	**3**
4(b)	*one mark for correct order:* G_1, S, G_2 **;** *G_1 phase:* transcription **or** translation **or** polypeptide / protein / enzyme, synthesis **or** (named) organelle synthesis **;** *S phase:* DNA replication / formation of 2 (sister) chromatids **;** *G_2 phase:* as G_1 **or** microtubule synthesis **or** centriole replication **or** mitochondria division **or** check for / correct, errors in replication of DNA **;**	**4**

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Question	Answer	Marks
5(a)	**A** ref. to receptors (at neuromuscular junctions) for self-antigens *any **two** from:* 1 autoimmune disease **;** 2 failure to distinguish self and non-self (antigens) **;** **A** foreign for non-self 3 immune response / antibodies produced, against self-antigens **;** 4 binding of (specific) antibody to self-antigen (on the external cell surface membranes of muscle cells) **;** 5 faulty / AW, lymphocytes not destroyed **;**	**2**
5(b)	human immunodeficiency virus **;**	**1**
5(c)	*any **three** from:* *if T_h cell number is low:* 1 low T_h cells means increased risk of developing an infectious disease **;** 2 low levels / less, cytokine, secreted / AW **;** *role of cytokine:* 3 stimulates activity of macrophages / produces angry macrophages **;** 4 stimulates, B-lymphocytes / plasma cells / humoral, response **;** **A** activate B-lymphocytes 5 (so lower concentrations / less / no), antibody, produced / secreted **;** 6 stimulates, T-cytotoxic / T-killer, cells **;** 7 (so) fewer infected cells killed **;** 8 more time for pathogens to, reproduce / spread **;** 9 <u>fewer</u> memory cells (to fight future infection) **;**	**3**

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Question	Answer	Marks
5(d)(i)	*any **three** from:* *receiving treatment (max 2):* 1 percentage of people living with HIV receiving treatment increases **;** 2 low rate of increase between 2000 and, 2003 / 2004 **;** 3 data to support **;** e.g. 3% / 4%, in 2000–2003, 45% in 2015 *deaths:* 4 increase in HIV / AIDS-related deaths to, 2004 / 2005, then decrease **;** **A** peak in 2004 / 2005 5 data to support **;** e.g. *two of:* start at 1.5 million, peak at 2 million, end at 1.2 million (2 of these)	**3**
5(d)(ii)	*any **two** from:* 1 lack of trained personnel to deliver treatment **;** 2 some people unwilling to take treatment **;** 3 isolated areas / difficulty getting treatment to people **;** 4 inability to, supply / produce, enough drugs **;** 5 not all people living with HIV, know their status / have been diagnosed **;** 6 AVP **;**	**2**

Question	Answer	Marks
6(a)	*any **two** from:* 1 water moves into, cell / vacuole, by osmosis / down water potential gradient **;** 2 (large) vacuole full of, water / sap **;** 3 turgid / vacuole exerts outward pressure **;** 4 hydrostatic (support) **;**	**2**
6(b)(i)	number of times an image is larger than, actual / real, size **;** **A** image size ÷ actual size **R** increase in size of specimen or object	**1**

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Question	Answer	Marks
6(b)(ii)	(×) 2000 **;** **;** *if incorrect:* one mark for correct working 70 000 / 35 **or** one mark for correct measurement **and** division by 35 e.g. 70 mm / 35 7 cm / 35	**2**
6(c)(i)	*transport mechanism:* active, transport / uptake **;** *explanation (max 2):* (vacuole) has higher concentration of hydrogen ions (than in cytosol) **;** hydrogen ions need to move against the (concentration) gradient **;** ATP / energy, needed **;** membrane <u>protein</u> needed **;**	**3**
6(c)(ii)	*any **three** from:* charged particles / ions, cannot cross, hydrophobic core / region of fatty acid tails / AW **;** movement through specific membrane <u>protein</u> **;** membrane protein only allows one-way movement **;** **A** no membrane proteins to allow outward flow AVP **;** e.g. suggestion that binding site is on the cytosol side	**3**
6(c)(iii)	*any **two** from:* acid hydrolases, break down / digest / hydrolyse **;** ref. to leakage from vacuole **;** avoids, damage to / breakdown of, cell contents / organelles / molecules (in the cytosol) **;**	**2**

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