Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/23**

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)	one nucleotide circled **;**	**1**
1(b)	cytosine <u>and</u> guanine **;** three hydrogen bonds between the base pairs **;**	**2**
1(c)	(3) 5,4,1,2 **;**	**1**
1(d)	**I** maintains length of chromosomes / prevents chromosome shortening *any two from:* permit continued replication **;** prevent loss of genes **;** **I** prevents gene damage **A** genetic / coded, information **A** protein coding regions of DNA protect ends of chromosomes from being, degraded / AW **;** AVP **;** e.g. prevents ends of chromosomes from being attached to each other not mistaken for a break in DNA that needs repairing	**2**

Question	Answer	Marks
2(a)	correctly stated formula **;** e.g. actual diameter = image length / magnification magnification = image length / actual diameter allow a magnification triangle 1750 (μm) **;** (*for 70 mm*) *credit also measurements made to 0.5 mm* **A** 1700 (μm) (*for 68 mm*) **A** 1725 (μm) (*for 69 mm*) **A** 1775 (μm) (*for 71 mm*) **A** 1800 (μm) (*for 72 mm*)	**2**
2(b)(i)	squamous epithelial (tissue) **; A** pavement epithelial (tissue)	**1**

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Question	Answer	Marks
2(b)(ii)	*any two from:* (alveoli have) thin wall / wall is one cell thick **;** **A** wall composed of thin cells **R** thin membrane **R** thin cell wall *idea of* short diffusion distance **;** *in context of between alveolar space and, blood / capillary* elastic tissue, qualified **; A** elastin / elastic fibres e.g. stretch and recoil for, ventilation / inhalation and exhalation maintaining steep, diffusion / partial pressure, gradient (many) alveoli provide a large surface area (for diffusion) **;** **I** *idea that a single alveolus has a large surface area* AVP **;** surfactant, prevents alveolar collapse / maintains inflation **I** *ref. to* moist lining	**2**
2(c)	*any three from:* 1 loosely packed spongy mesophyll cells / spongy mesophyll cells surround air spaces / air spaces between spongy mesophyll cells **;** 2 large, surface / area, for evaporation (of water to air space) **;** *In context of spongy mesophyll cells, surfaces / cell walls* 3 (cells arranged so that), air spaces above the stomata / sub-stomatal air spaces **;** 4 *ref. to* evaporation creates saturated air spaces / water vapour collects in air spaces **;** 5 *idea of* creates water potential gradient between air in air spaces and air in external environment **;** 6 AVP **;** e.g. guard cells situated in epidermis to form stomatal pore *ref. to* xylem, close proximity to spongy mesophyll cells for passage of water / passes on water to spongy mesophyll cells	**3**

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Question	Answer	Marks
2(d)(i)	*accept au for arbitrary units and first hour etc. for 08.00 etc.* *any three from:* 1 between 08.00 and 09.00, steep increase / increase from 2.5 au to 5 au **;** 2 highest rate / peak, at 09.00 **;** **A** maximum rate is at 09.00 3 fluctuates / AW, between 10.00 and 15.00 **;** 4 (continued) decrease between 15.00 and 19.00 **;** **A** steep /steepest, decrease between 15.00 and 16.00 **A** less steep (than 15.00 to 16.00) decrease between 16.00 and 19.00 5 comparative data quote for decrease **;** e.g. 3.8 au at 15.00 to 0.5 au at 19.00 **or** 3.8 au at 15.00 to 2.00 au at 16.00 **or** 2.0 au at 16.00 to 0.5 au at 19.00	**3**
2(d)(ii)	*any two from:* *change in external environmental factor* decrease in light intensity / AW **;** **A** (less sunlight because it was) cloudy decrease in temperature / AW **;** *temperature decreased because it was cloudy is mp2 only* decrease in, wind speed / air movement / AW **;** increase in humidity / raining / AW **;** stomata, decrease in (aperture) size / open less wide **;** decreased evaporation (rate) **;** water vapour diffuses out less rapidly / less steep water potential gradient **;** AW AVP **;** e.g. suggestion of xerophytic feature occurring in response to increased, temperature / light intensity (to 09.00)	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>one mark each row
<table>
<tr><th>cell structure</th><th>V. cholerae</th><th>epithelial cell from the human intestine</th></tr>
<tr><td>cell wall</td><td>✓</td><td>✗</td></tr>
<tr><td>cell surface membrane</td><td>✓</td><td>✓;</td></tr>
<tr><td>ribosomes</td><td>✓</td><td>✓;</td></tr>
<tr><td>large permanent vacuole</td><td>✗</td><td>✗;</td></tr>
<tr><td>organelles surrounded by a double membrane</td><td>✗</td><td>✓;</td></tr>
</table></td><td>4</td></tr>
</table>

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Question	Answer	Marks
3(b)	**I** better sanitation unqualified **I** *ref. to* unclean water *any five from :* *ref. to* treat drinking water **;** **A** clean / sterilised / chlorinated / safe / bottled / boiled **A** *ref. to* water treatment plants provide sewage treatment plants **; A** treat waste water / containment of sewage / provide latrines (in temporary camps) **;** *ref. to* keeping sewage and (drinking) water sources separate **;** **A** examples e.g. avoid swimming downstream of sewage outlets avoid defaecating near rivers used for washing water treatment plants upstream of sewage disposal bury faeces *ref. to* vaccination / providing vaccines **;** *ref. to* education in ways to prevent spread **;** *ref. to* (encourage) hand washing **;** *ref. to* food hygiene **;** e.g. use of clean cooking utensils / covering food to prevent flies landing / washing food in treated water / cook food thoroughly / peel fruit and vegetable washed in (suspected) contaminated water discourage use of human faeces for fertiliser / use fertiliser other than human faeces / do not irrigate plant food with contaminated water**;** control breeding of, vectors / flies **;** rapid diagnosis **;** rapid treatment (for earlier recovery to minimise risk of spreading) **;** *ref. to* oral rehydration, salts / therapy ; use of antibiotics ; *ref. to* isolation / quarantine **;**	**5**

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Question	Answer	Marks
3(c)(i)	to, bind / attach / AW, HIV / virus / pathogen, to, host cell / T-lymphocyte / T-cell **;** (because it) binds / is complementary, to, CD4 receptor proteins / AW **;** *ref. to* binding leads to, entry of virus into cell / endocytosis / fusion of viral envelope with host cell (surface) membrane **;**	**2**
3(c)(ii)	*ref. to* less cytokine (released) **;** *in context of fewer helper T-lymphocytes* *any one from:* (so) fewer B-lymphocytes divide by mitosis / AW **;** **A** humoral response decreased (so) fewer B -lymphocytes stimulated to differentiate into plasma cells / AW **;** (so) fewer plasma cells to, produce / secrete antibodies **;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>
any two from:

note that some mark points must have both xylem and phloem mentioned (‘v’) and some mark points only need xylem or phloem (‘or’ – below the line)
<table>
<tr><th>xylem</th><th></th><th>phloem</th><th></th></tr>
<tr><td>no cytoplasm / hollow / no contents</td><td>v</td><td>(peripheral / little / some) cytoplasm I protoplasm
R full of cytoplasm / AW
or
has (a few) organelles
A examples of organelles
mitochondria or ER
I has SER / RER / ribosomes
R has nucleus</td><td>;</td></tr>
<tr><td>lignified
R idea of lignin within element</td><td>v</td><td>no lignin / (only) cellulose</td><td>;</td></tr>
<tr><td>no end wall(s) / no sieve plate(s)
A end walls have broken down</td><td>or</td><td>sieve plate(s) / perforated end wall (s)
A (end walls) have sieve pores</td><td></td></tr>
<tr><td>(side walls) contain pits
R piths</td><td>or</td><td>no pits ;</td><td>;</td></tr>
<tr><td>no plasmodesmata</td><td>or</td><td>plasmodesmata (to companion cells) ;</td><td>;</td></tr>
<tr><td>thick(er), cell wall / walled</td><td>or</td><td>thin(ner), cell wall / walled</td><td>;</td></tr>
</table>
thicker lignified wall = thicker wall mark only (for lignin mark need to state what phloem has)
</td><td>2</td></tr>
</table>

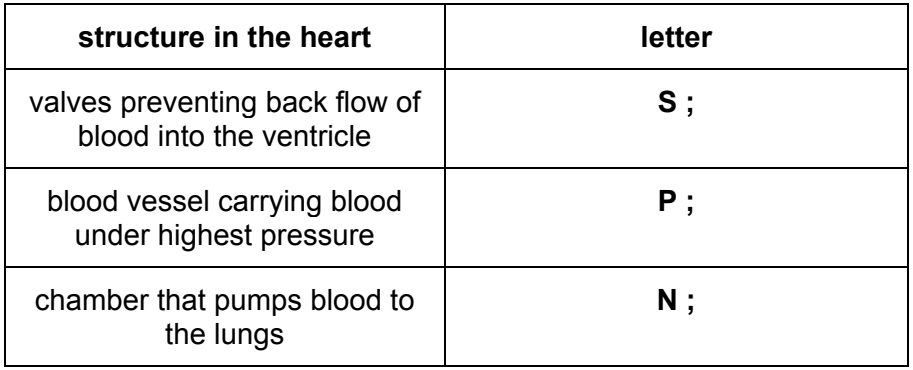
Question	Answer	Marks
4(b)	*any two from:* to hydrolyse / break, glycosidic bonds **;** to produce, reducing sugars / fructose and glucose **;** **A** to make reactive groups (to Benedicts) available to be able to test with Benedict's solution to obtain a positive result **;** **A** description of positive result sucrose, is a non-reducing sugar / has no reactive groups when tested with Benedict's solution **;**	**2**
4(c)(i)	(large number of mitochondria) provide ATP, for active transport / for protein synthesis **;** (large number of ribosomes) to synthesise the, proton pumps / carrier proteins / AW **;**	**2**
4(c)(ii)	*any three from:* H^+, pumped / actively transported (out of companion cell into cell wall) **or** *ref. to* higher concentration of H^+ (in cell wall) / H^+ gradient builds up (between cell wall and cytoplasm of companion cell) **;** H^+ move back (into companion cell) by facilitated diffusion **; I** sucrose through, co-transporter protein / cotransporter **; A** symporter H^+ cotransports sucrose / sucrose moves (into cell) with H^+ **;** sucrose is transported against the concentration gradient **;** **A** sucrose transported by secondary active transport	**3**

Question	Answer	Marks
5(a)(i)	phagocytosis (of, dead cells / pathogens / AW) **;** **A** endocytosis of pathogens	**1**
5(a)(ii)	(sodium chloride) solution has lower water potential (than cytoplasm) **;** ora **A** Ψ *for water potential* water, leaves / AW, cell by <u>osmosis</u> **;**	**2**
5(b)(i)	13.56 ; **A** 13.6 / 14	**1**

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Question	Answer	Marks
5(b)(ii)	*allow (red) blood cell count for mean red blood cell count* *allow **ora*** *any four from:* 1 description of data **;** e.g. lowest mean red blood cell count for, (population) **A** / lowest altitude (populations) **B**, **C** and **D** / all other altitudes, have a higher mean red blood cell count than **A** / 695m altitude (population) **B** has highest mean red blood cell count (population) **B** has higher mean red blood cell count than **C** and **D** *physiological explanation population **A** compared to **B/C/D*** 2 decrease in partial pressure of oxygen in the atmosphere with increase in altitude / AW **or** lower partial pressure of / less, oxygen in, inhaled air / lungs / alveoli AW 3 *ref. to* haemoglobin **;** e.g. lower saturation of haemoglobin with oxygen (in lungs) lower affinity of haemoglobin for oxygen (in lungs) more haemoglobin required to carry sufficient oxygen to tissues 4 suggestion of increase in count at 1676 m and above **;** e.g. rate of production of red blood cells increases higher erythropoietin (EPO) levels *ref. to* changed proportion of plasma to red blood cells / plasma volume decreases 5 little difference between **B**, **C** and **D** / AW **;** 6 differences in altitude are not great / AW **;** *in context of **B, C, D*** 7 *ref. to* genetic differences / adaptation to environment **;** *allow if general statement includes population **A*** 8 AVP **;** e.g. *ref. to* differences in demographics	**4**

Question	Answer	Marks
5(c)	less haemoglobinic acid is formed / fewer hydrogen ions to bind to haemoglobin (to cause dissociation of oxygen) **;** *any one from:* binds to allosteric site / site other than active site (of enzyme), qualified **;** e.g. causes change in shape of active site substrate cannot bind to active site fewer / no, enzyme-substrate / ES, complex formation prevents / reduces / AW, carbonic acid / H_2CO_3, formation / AW **;** **A** fewer hydrogen ions produced from carbonic acid dissociation	**2**

Question	Answer	Marks
6(a)		**3**

structure in the heart	letter
valves preventing back flow of blood into the ventricle	**S ;**
blood vessel carrying blood under highest pressure	**P ;**
chamber that pumps blood to the lungs	**N ;**

Question	Answer	Marks
6(b)	*treat as neutral effects of nicotine on the brain and ref. to adrenaline* *any three from:* increased heart rate **;** **I** increased heart beat increased blood pressure **;** increases risk of, blood clotting / thrombus formation **;** **A** increases risk of thrombosis **A** increases stickiness of platelets damages the endothelium **;** AVP **;** e.g. stimulates vasoconstriction / reduces the diameter of blood vessels **A** named blood vessel types	**3**
6(c)(i)	*any one from:* two nuclei vs one **;** *ref. to*, DNA / chromosome, content **;** cytokinesis has not occurred **;** **A** cytoplasm has not divided (into two cells)	**1**
6(c)(ii)	*any two from:* *in context of cardiac myocyte or overall heart function* unable to replace, damaged / worn out / old, cardiac myocytes **;** **R** repair myocytes unable to repair (damaged) cardiac, muscle / tissue **;** **A** heart tissue repair (to cardiac muscle may be) with, unspecialised cells / scar tissue **;**	**2**

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