Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **March 2021**

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.

Cambridge International is publishing the mark schemes for the March 2021 series for most Cambridge IGCSE™, Cambridge International A and 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.

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.

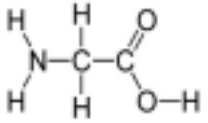
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Mark scheme abbreviations

;	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

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Question	Answer	Marks
1(a)	**X** = mucous gland **;** **Y** = cartilage **;** **A** chondrocytes	**2**
1(b)	(fibrous / structural) protein **;**	**1**
1(c)	alveolus 'no' and all other boxes 'yes' **;**	**1**

Question	Answer	Marks
2(a)(i)	sequence of nucleotides **or** length / section / AW, of DNA **;** **A** bases for nucleotides (a gene can) code for a polypeptide **;** **A** protein for polypeptide	**2**
2(a)(ii)	 amino group added correctly **;** **A** H_2N (remaining part of) carboxylic acid group added correctly **;** **A** OH for O–H	**2**
2(a)(iii)	amylose and amylopectin **;**	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)</td><td>one mark for glucose and starch rows ;
one mark for maltase row ;
one mark for maltose row ;
<table>
<tr><th>substance</th><th>polysaccharide</th><th>monosaccharide</th><th>macromolecule</th></tr>
<tr><td>glucose</td><td>✗</td><td>✓</td><td>✗</td></tr>
<tr><td>maltase</td><td>✗</td><td>✗</td><td>✓</td></tr>
<tr><td>maltose</td><td>✗</td><td>✗</td><td>✗</td></tr>
<tr><td>starch</td><td>✓</td><td>✗</td><td>✓</td></tr>
</table></td><td>3</td></tr>
<tr><td>2(c)</td><td>any one valid suggestion ;
e.g. easier to extract
idea that microorganisms can be cultured in large quantities and produce large amounts of enzyme
higher rate of reaction
active over a greater temperature range</td><td>1</td></tr>
<tr><td>2(d)(i)</td><td>any three from:

1 increase in temperature increases kinetic energy of, molecules / particles / substrate / enzyme ;
A moving around faster

2 (increase in temperature) increases rate of, successful collisions between enzyme and substrate / enzyme–substrate complex formation / substrate binding to active site ;
OR
at 48 °C (47 or 49) ref. to, optimum temperature / maximum enzyme activity / active sites binding substrate at maximum capacity / AW ;

3 (at temperatures higher than optimum) ref. to denaturation / loss of shape of active site (and decrease in activity) ;

4 AVP ; e.g. weaker / hydrogen, bonds break (and ref. to denaturation)</td><td>3</td></tr>
</table>

Question	Answer	Marks
2(d)(ii)	optimum / peak / max activity / at 100% and to right of original **;** line beyond optimum must be to right and, reach vertical axis at 50% or below / reach horizontal axis **;**	**2**

Question	Answer	Marks
3(a)	*any **one** from:* stimulate / enhance / AW, macrophage response **;** stimulate / enhance / AW, B-lymphocyte / B-cell / humoral, response **;** **A** described part of humoral response e.g. increase antibody production stimulate / enhance / AW, T-killer / T-cytotoxic, response **;** AVP **;** e.g. suppresses immune response (during recovery) role in inflammation ref chemotaxis	**1**
3(b)(i)	*any **two** from:* *Leydig cell / not T-helper lymphocyte, because:* much / many / high proportion of, smooth endoplasmic reticulum **;** (smooth endoplasmic reticulum present) that functions to synthesise, cholesterol / testosterone / steroid hormones / lipids **;** no / little, rough endoplasmic reticulum **;** rough endoplasmic reticulum is for polypeptide / protein synthesis **;**	**2**
3(b)(ii)	transmission electron micrograph **;** *plus one from:* cell ultrastructure can be seen / high resolution **;** **A** detail e.g. membranes of mitochondrion cristae nuclear, envelope / membranes endoplasmic reticulum **I** rough / smooth (very) thin section / not surface contours **/** AW **;** **I** ref. to magnification	**2**

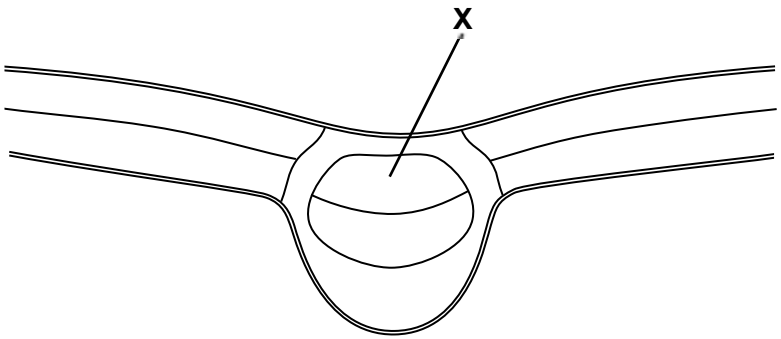
Question	Answer	Marks
3(c)(i)	*one correct mechanism stated plus one associated detail* (passive / simple) diffusion **;** **R** facilitated diffusion / diffusion through (membrane) protein from high(er) to low(er) concentration **/** down a concentration gradient **;** AVP **;** e.g. via phospholipid bilayer / hydrophobic core / fatty acid tails / AW **or** endocytosis **;** description / pinching in / vesicle formation **;** AVP **;** e.g. ATP / energy, required	**2**
3(c)(ii)	*any **two** from* hydrophilic / water soluble / polar **;** cannot cross, hydrophobic core (of phospholipid bilayer) / AW **;** too large (to pass through gaps in fatty acid tails) **;** no (specific), transport / carrier, proteins **;**	**2**

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Question	Answer	Marks
4(a)(i)	**C** = red blood cell / erythrocyte **A** red blood corpuscle **D** = lymphocyte **A** plasma cell **R** if also stated as granulocyte **A** B- or T-Cell **I** white blood cell / leucocyte / agranulocyte **E** = monocyte **R** if also stated as granulocyte **I** white blood cell / leucocyte / agranulocyte **A** macrophage **F** = neutrophil **A** eosinophil **A** basophil **R** if also stated as agranulocyte **I** white blood cell / leucocyte / granulocyte **C** correct = one mark **D** correct = one mark **E** and **F** correct = one mark	**3**
4(a)(ii)	*any **two** from:* *more white blood cells because* result of immune response **;** clonal expansion / described, of, B- / T-, lymphocytes / cells **;** idea of producing (large quantity of specific) antibody in context of immune response increased, production of macrophages / phagocytes **;** *if written in context of HIV/AIDS as the infectious disease* fewer white blood cells **;** further detail **;** e.g. T-helper lymphocytes destroyed	**2**

Question	Answer	Marks
4(b)	**1** decreased / 13% less, percentage oxygen saturation / percentage saturation haemoglobin with oxygen and similar (quantity) / same (quantity) / 0.1 cm^3 per 100 cm^3 blood less, oxygen delivered by haemoglobin to tissues **;** *plus any **three** from:* **2** at high altitude lower partial pressure of oxygen, in atmosphere / in inhaled air / in alveolus / into pulmonary capillaries / AW **;** **3** in lungs / in pulmonary capillaries / at the alveolus, less oxygen, binds to / taken up by / AW, haemoglobin **;** **4** haemoglobin has lower affinity for oxygen (in lungs) **;** **5** increased production of haemoglobin **;** **6** increased, production / number / density, of red blood cells **;** **A** increased haematocrit **7** (so) more haemoglobin available to bind oxygen **/** same quantity of oxygen can be taken up as at sea level **;** **8** AVP **;** e.g. ref. to decreased plasma volume increase in erythropoietin (EPO) concentration other described physiological change	**4**
4(c)	absence of, good health / well-being / lack of <u>physical</u> well-being / AW **;** **A** disorder / illness further detail **;** e.g. having an adverse effect reduced / impaired, function **A** described e.g. less oxygen, taken up / transported produces, (specific) signs / symptoms **;** **A** described symptoms	**2**

Question	Answer	Marks
5(a)(i)	*if one phase not attempted, max 3* *any **four** from:* *S phase:* **1** DNA replication **;** explanation: **2** produces two genetically identical, DNA molecules (one for each daughter cell **;** **A** (sister) chromatids for DNA molecules **A** description of semi-conservative replication *metaphase:* **3** chromosomes / pairs of sister chromatids align / orientate at (spindle) equator **;** **A** metaphase plate for equator **;** *explanation:* **4** chromosomes orientated so that sister chromatids will be shared out to daughter cells / AW **;** *anaphase:* **5** centromere splits / spindle fibres shorten / AW **;** *explanation:* **6** so that daughter chromosomes / sister chromatids / identical chromatids, move to opposite poles **;** **7** AVP **;** e.g. ref. to checkpoints **and** ref. to error, detection / repair ref. to kinetochore / centromere, and attachment to spindle fibres at, metaphase / anaphase	**4**
5(a)(ii)	unequal sharing out of, cytoplasm / organelles / named organelles, (at cytokinesis) **;** **A** uneven sizes	**1**

Question	Answer	Marks
5(b)(i)	*max 3 structural changes:* **1** ref. to function of xylem **;** e.g. transport of water and (dissolved) mineral ions transport of water from roots to other parts of the plant *in context of leaf xylem* receipt of water from roots **2** end walls broken down **;** **3** (so) tubes form (to transport water long distances) **;** **4** (so), uninterrupted / unhindered / continuous, flow **;** **5** ref lignification **;** **6** lignin strengthens vessels **;** 7 ref. to cell death **;** **8** cells, become hollow / lose contents / lose cytoplasm **or** organelles / named organelles, digested / broken down **;** **9** greater quantity of water can flow (per unit, time / length) **;** **10** AVP **;** e.g. tonoplast / vacuole, breakdown / rupture, to release hydrolytic enzymes ref. to xylem patterning during growth ref, to pits	**4**
5(b)(ii)	label line to xylem, labelled **X ;**  	**1**
6(a)	*Vibrio <u>cholerae</u>* **;**	**1**

Question	Answer	Marks
6(b)	*any **three** from:* **1** cholera already, endemic / present, in area **;** **2** contaminated water / water contains pathogen **;** **R** polluted water **3** pathogen transmitted by, faecal–oral route / AW **;** **4** ref. to changed living conditions **;** e.g. no piped, treated, drinking water / disruption to water treatment plants no safe disposal of sewage / disruption to sewage treatment plants **5** ref. to inability to practise good hygiene **;** e.g. washing (utensils) in contaminated water not able to wash hands after defaecation latrines not covered **6** AVP **;** e.g. ref. to flies transferring pathogen from, uncovered latrines / (contaminated) faeces	**3**
6(c)(i)	*any **three** from:* **1** mRNA unable to bind **;** **2** ribosome subunits unable to come together **;** **3** tRNA unable to, enter / bind to, ribosomes **;** **4** mRNA codon–tRNA anticodon binding prevented **;** **5** translation, prevented / does not begin **or** polypeptide synthesis prevented / polypeptides not synthesised **;** **A** protein for polypeptide **6** enzymes required for growth not produced / example of role of protein in growth e.g. for membrane formation **;**	**3**
6(c)(ii)	cell wall **;**	**1**

Question	Answer	Marks
6(d)	*any **four** from:* *vaccination programme to max 3:* **1** vaccines stimulate **(**active**)** immunity to cholera / AW **;** **2** idea that if infected with, pathogen / *V. cholerae*, people do not become ill with cholera or the immune system destroys pathogen before it can, cause harm / spread **;** **3** ref. to herd immunity **;** **A** described e.g. enough people effectively immunised to prevent spread idea that unvaccinated people surrounded by immunised people **4** AVP **;** e.g. idea that reduces reservoir of pathogen in population *treatment to max 3:* **5** (oral / intravenous) rehydration therapy, decreases recovery time / cures more quickly **;** **6** (more likely that) contaminated faeces disposed of safely **/** decreased risk of spread via contaminated faeces **7** more able to practise good hygiene **;** **8** time spent in medical centre acts as quarantine / infected people not in general population **;** **9** (so) decreases, density / proportion, of infected people to reduce risk of spread **;** **10** AVP **;** e.g. medical centres able to monitor antibiotic use and provide most effective medication medical centres, accessible to many parts of the country / widespread idea that medical centres mean people treated sooner decreasing time when people are infectious injecting antibodies	**4**