Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **February/March 2022**

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 February/March 2022 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.

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 the candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument

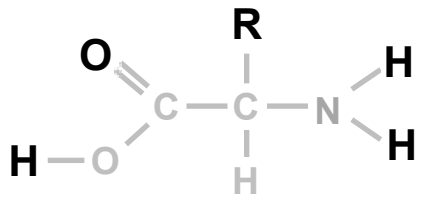
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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>1 mark for each correct row ; ; ; ;
<table>
<tr><th rowspan="2">statement</th><th colspan="3">process</th></tr>
<tr><th>active transport</th><th>facilitated diffusion</th><th>simple diffusion</th></tr>
<tr><td>movement of oxygen into a red blood cell</td><td>✖</td><td>✖</td><td>✓</td></tr>
<tr><td>occurs in both animal and plant cells</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>uses carrier proteins</td><td>✓</td><td>✓</td><td>✖</td></tr>
<tr><td>movement of non-polar molecules between the fatty acid tails of the phospholipid molecules</td><td>✖</td><td>✖</td><td>✓</td></tr>
<tr><td>movement of ions down a concentration gradient</td><td>✖</td><td>✓</td><td>✖</td></tr>
</table></td><td>4</td></tr>
<tr><td>1(b)(i)</td><td>a line drawn to any of the 4 black rectangles shown in the cell wall of the cells three from the right
and
labelled with the letter C ;</td><td>1</td></tr>
<tr><td>1(b)(ii)</td><td>provides, large / high, surface area
or
provides a, large / high, surface area : volume (ratio) ;</td><td>1</td></tr>
<tr><td>1(b)(iii)</td><td>apoplastic / apoplast ; I cell wall route</td><td>1</td></tr>
</table>

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Question	Answer	Marks
1(c)	*any **three** from:* 1 cohesion **/** hydrogen bonding**,** between water molecules **;** 2 detail about H bonding **;** e.g. oxygen has, small **/** δ negative charge**,** hydrogen has small **/** δ positive charge water molecules are polar so attract each other 3 adhesion **/** hydrogen bonding**,** between water molecules and, cell wall / xylem wall **/** cellulose / hydrophilic regions of lignin **;** 4 adhesion **/** AW), supports the column of water **;** 5 transpiration **/** evaporation (from leaves)**,** pulls the column **or** ref. to tension from, above **/** leaves **or** ref. to water potential gradient from roots to leaves **;**	**3**

Question	Answer	Marks
2(a)(i)	metaphase **;**	**1**
2(a)(ii)	4 chromosomes within dotted line of both newly forming cells **and** each chromosome consisting of one chromatid **;** **ignore** shape / shading labels not required centromeres do not need to be shown two obvious pairs (of chromosomes) shown in each of the two re-forming nuclei **;** e.g. two dark and two light two longer and two shorter	**2**
2(b)	*any **one** from:* prevent the loss of, genes / genetic information **;** **A** prevent loss of coding DNA AVP **;** e.g. prevents the ends of two chromosome from fusing / joining	**1**
2(c)	*any **three** from:* 1 stem cells (grown in the lab) can undergo mitosis, **;** **A** divide 2 stem cells are, undifferentiated **/** unspecialised **;** 3 (when back in the person being treated) stem cells can, differentiate **/** specialise, into (all) <u>blood cell</u> types **;** **A** are multipotent 4 to, re-populate / replace / bring back to normal levels, the person's own <u>blood cell</u> supply **;** **A** tissue repair	**3**

Question	Answer	Marks
3(a)	all 4 atoms and the R group correct **;** 	**1**
3(b)(i)	0.4 (min^{-1}) **;**	**1**
3(b)(ii)	straight line that continues to rise across all concentrations / line does not level off at higher concentrations **;**	**1**
3(c)(i)	*any **three** from:* 1 at low, catechol **/** substrate, concentrations there are many active sites available **;** 2 adding more substrate increases the rate of, enzyme–substrate complex formation **/** more successful collisions **/** AW **;** 3 at high(er) substrate concentrations all the active sites are, occupied / saturated **;** 4 at low substrate concentrations the substrate is the limiting factor **or** at high substrate concentrations the enzyme concentration is a limiting factor **or** at high substrate concentrations some factor other than substrate concentration is the limiting factor **;** 5 number of active sites does not change **/** AW **;**	**3**
3(c)(ii)	0.21 ($mol\ dm^{-3}$) **;**	**1**
3(c)(iii)	catechol oxidase has a higher affinity for methylcatechol than for catechol / ora **;**	**1**

Question	Answer	Marks
4(a)	*any **one** from:* *Mycobacterium tuberculosis* ; *Mycobacterium bovis* ;	**1**
4(b)	length X–Y (in mm) × 1000 ÷ 21 000 ; 1.7–1.8 (μm) (to 2 significant figures) ;	**2**
4(c)	*any **two** from:* peptidoglycan cell wall ; circular DNA ; naked DNA / DNA without histones ; 70S ribosomes ; DNA not enclosed by nuclear envelope ; **A** no (true) nucleus absence of, (double) membrane-bound organelles / named example of (double) membrane-bound organelle ; AVP ;	**2**
4(d)	*any **three** from:* *does not support:* 1 much larger proportion do not have HIV / AIDS / AW ; 2 data to support ; e.g. deaths of people from TB with HIV / AIDS is 0.25 million out of 1.5 million 3 other factors may cause more deaths from TB ; *supports:* 4 large proportion of deaths of people with HIV / AIDS are caused by TB ; 5 data to support ; e.g. deaths of people with HIV/AIDS caused by TB is a minority / 0.25 million out of 0.75 million 6 fewer people will be immune compromised ; 7 AVP ; e.g. ref. to different modes of transmission so, cases of / deaths from, TB may not change not enough information, qualified	**3**

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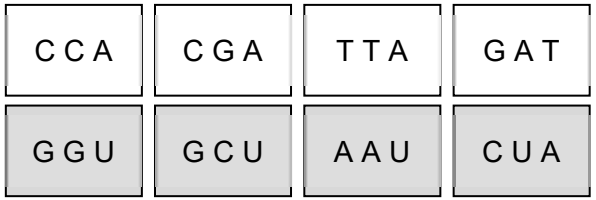
Question	Answer	Marks
4(e)	*any **three** from:* 1 ref. to opportunistic infections causing death **;** 2 low levels of **/** less, cytokine, secreted / AW **;** 3 two from activity of macrophages not stimulated B-lymphocyte **/** plasma cells / humoral response, not stimulated **A** activate B-lymphocytes **/** activate B cells (so) lower concentrations of **/** less / no, antibody, produced **/** secreted **;** stimulates, T-cytotoxic **/** T-killer, cells **;** 4 (so) fewer, bacteria killed / viruses eliminated / pathogens killed **;** 5 fewer memory cells (to fight future infection) **;** 6 AVP **;** e.g. idea of overburdened immune system	**3**

Question	Answer	Marks
5(a)(i)	mitral / bicuspid / atrioventricular, valve **and** left ventricle **and** semilunar / aortic, valve **and** aorta **;**	**1**
5(a)(ii)	lack of, glucose / oxygen, to (some) brain cells (so cells cannot respire) **;**	**1**
5(b)	*any **three** from:* 1 normally only SAN in (wall of) right atrium sends out impulses **;** 2 ref. to extra impulses (from wall of left atrium) **;** 3 atrial systole might occur when it should be in diastole **;** 4 impulses interfere with each other **/** AW **;** 5 SAN no longer able to act as a pacemaker **;** 6 rapid since extra contractions **;**	**3**

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Question	Answer	Marks
5(c)(i)	**X** = carbonic anhydrase **;** **Y** = haemoglobinic acid **;**	**2**
5(c)(ii)	*idea of* a negative ion (chloride) entering RBC replaces a negative ion (hydrogencarbonate) leaving / reducing charge separation (across the membrane) / maintaining electrical neutrality of the cell **;**	**1**
5(d)	tissue fluid **;** **I** lymph	**1**
5(e)	*any **three** from:* 1 production of mucus by, mucous glands / goblet cells **;** 2 mucus (is sticky and) traps particles of dust **;** **I** pathogens, microbes, bacteria, etc. 3 cilia on ciliated epithelial cells **;** **A** ciliated epithelium 4 cilia, waft / move, mucus / AW **;** 5 *idea of* mucus with, particles / dust, is moved away from lung tissue **;**	**3**

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Question	Answer	Marks
6(a)(i)	**E** = deoxyribose **;** **F** = cytosine **;**	**2**
6(a)(ii)	a ring drawn around 1 base, 1 deoxyribose and 1 phosphate on the same strand and passing through the H bonds **;**	**1**
6(a)(iii)	phosphodiester **;**	**1**
6(b)	All 4 triplets must be correct **;** 	**1**
6(c)	*any **two** from:* removal of introns **/** non-coding sequences **;** leaving, exons / coding sequences (joined) **;** ref. to splicing RNA transcript = 1 mark AVP **;** e.g. adding a 5′ cap / 3′ poly A tail	**2**

Question	Answer	Marks
6(d)	*any **five** from:* 1 two codons at a time are exposed (to the large subunit) **;** 2 (idea of) a specific tRNA brings a specific amino acid **;** 3 a tRNA anticodon binds to the mRNA codon **;** 4 complementary base pairing occurs (by hydrogen bonding) **;** 5 a second tRNA brings another amino acid (next to the first amino acid) **;** 6 peptide bond formation between the two amino acids **;** 7 ribosome moves along the mRNA, one codon at a time / and next codon is 'read' **;** 8 the first tRNA leaves the ribosome **;** 9 AVP **;** e.g. first codon is always AUG first anticodon is always UAC first amino acid is always methionine ribosome moves along mRNA in a 5' to 3' direction role of peptidyl transferase eventually a stop codon is reached (and translation stops)	**5**

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