Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **October/November 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 October/November 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.

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
mp	marking point

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Question	Answer	Marks
1(a)(i)	translation **;**	**1**
1(a)(ii)	**A** – messenger RNA / mRNA **;** **B** – transfer RNA / tRNA **;** **C** – (poly)peptide (chain) **;** **I** PPC / (primary structure of) protein / amino acid chain	**3**
1(a)(iii)	*accept names of bases* **D** – AAA **E** – GUG **;**	**1**

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Question	Answer	Marks
1(b)	*any **four** from:* *structure to max three* *ignore all refs to DNA and red blood cells* 1 different amino acid will have different, R group / side chain **;** **A** glutamic acid / glu, to, valine / val 2 may prevent formation of bond(s) between R groups **;** 3 may form, new / different, bond(s) between R groups **;** 4 change in, secondary / 2° / tertiary / 3° / quaternary / 4°, structure **;** **A** change in, globular shape / 3D shape **A** different folding of, β-globin / polypeptide / haemoglobin **R** quaternary if referring to, a single polypeptide / β-globin 5 any further detail on, 2° / 3° / 4°, structure **;** e.g. interactions between α-globin and β-globin may change / AW 6 AVP **;** e.g. change from, polar / charged / hydrophilic, to, non-polar / non-charged / hydrophobic (R group / amino acid) *function* 7 change in ability, to bind / AW, to oxygen / carbon dioxide **;** **A** lower / higher for change **A** change in percentage saturation of haemoglobin with oxygen **A** change in affinity for, oxygen / carbon dioxide **A** changes the volume of, oxygen / carbon dioxide, carried **A** carry, more / less, oxygen / carbon dioxide **R** if haemoglobin is said to have an active site	**4**

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Question	Answer	Marks
2(a)	*any **two** from:* anything within range 0.6 to 0.8 **;** μmol dm^{-3} min^{-1} / μmol per dm^3 per min **;** **A** μmol per dm^3 / min *or* μmol dm^{-3} / min	**2**
2(b)(i)	*ignore any explanation* *any **two** from:* 1 initial rate will be, lower / slower **;** 2 takes longer to reach the, plateau / end concentration / 10 μmol dm^{-3} **;** **A** longer to complete the reaction / maximum concentration 3 *idea that* the final / end, concentration of product will be, the same / 10 μmol dm^{-3} **;** **I** refs to the shape of the graph	**2**
2(b)(ii)	*ignore any explanation* *any **two** from:* 1 initial rate will be, higher / faster **;** 2 shorter time to reach, / plateau / end concentration / 10 μmol dm^{-3} **;** **A** shorter time to complete the reaction / maximum concentration 3 *idea that* the final / end, concentration of product will be, the same / 10 μmol dm^{-3} **;** **I** *ref. to* the shape of the graph	**2**

Question	Answer	Marks
2(c)	*any **two** from:* 1 allows a (valid) comparison of the, activities / AW, of the enzymes **;** 2 initial rate is the fastest rate **;** 3 *idea that* if rate is calculated over a longer period of time than the linear part of the curve the rate will vary **;** 4 not limited by substrate concentration / substrate is in excess **;** **A** 'no limiting factors' if substrate not mentioned 5 not influenced by (increase in concentration of) product **;**	**2**

Question	Answer	Marks
3(a)(i)	*any **three** from:* 1 no, nucleus / organelles **; ora** e.g. 'if they were white blood cells …' 2 cytoplasm is, homogeneous / AW **;** 3 about same, size / width / diameter, as lumen of capillary **;** 4 cells about 7 μm in diameter / AW **;** 5 flexible / variety of shapes / irregular shapes **;** 6 AVP **;** e.g. rouleau	**3**

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Question	Answer	Marks
3(a)(ii)	*assume answers are about tissue fluid unless told otherwise* *any **two** from:* 1 no red blood cells **;** 2 no platelets **;** 3 fewer (named) protein(s) / no large proteins / no plasma proteins **;** **A** no named plasma proteins (albumen / fibrinogen) **A** fewer plasma proteins only if stated that they are, small / leave blood 4 less, glucose / amino acids / fatty acids **;** 5 fewer, white blood cells / leucocytes / neutrophils / monocytes **;** **A** more macrophages **6** less / lower concentration of, oxygen **or** more / higher concentration of, carbon dioxide **;** **I** urea except in liver and muscle tissue **R** 'waste'	**2**
3(b)(i)	*ignore any explanations* (mean) percentage saturation of haemoglobin with oxygen (in blood leaving the lungs) decreases **;** (mean) haemoglobin concentration in blood increases **;** any suitable comparative data quote with altitude in m and mean Hb concentration in g 100 cm^{-3} ***or*** percentage saturation **;**	**3**

Question	Answer	Marks
3(b)(ii)	*any **three** from:* 1 more red blood cells **;** 2 larger red blood cells **;** 3 more haemoglobin per red blood cell **;** 4 more alveoli / larger surface area for gas exchange **;** **A** bigger lungs / larger chest volume / broader chest / larger capacity of lungs (total or vital) 5 higher, cardiac output / stroke volume / AW **;** **A** higher blood pressure in pulmonary artery 6 AVP **;** 7 AVP **;** e.g. higher tidal volume / deeper breaths higher ventilation rate (minute volume) **I** faster breathing *ref. to* erythropoietin / EPO, stimulating production of (more) red blood cells more red blood cells through alveolar capillaries per unit time	**3**

Question	Answer	Marks
4(a)	*any **two** from:* *cellulose molecules* 1 straight (chains) / linear / unbranched **;** 2 arranged in parallel **;** 3 hydrogen bonds between (cellulose) molecules **;** 4 any detail, e.g. between H of –OH groups and –O of –OH groups **;** **A** between -OH groups 5 AVP **;** e.g. cellulose molecules have, staggered / overlapping, ends **I** overlapping microfibrils	**2**
4(b)(i)	*any **three** from:* 1 two layers of phospholipid **;** 2 label for, phospholipids / phospholipid bilayer **;** 3 channel protein across whole bilayer with <u>hole through middle</u> + label **;** ecf if a monolayer shown or no phospholipids drawn 4 any additional feature + label **;** e.g. hydrophilic heads / hydrophobic tails / cholesterol / other named protein (e.g. glycoprotein)	**3**

Question	Answer	Marks
4(b)(ii)	*any **two** from:* 1 to allow facilitated diffusion **;** **R** active transport 2 ions are, charged / hydrophilic **;** 3 cannot pass through, hydrophobic core / phospholipid bilayer **;** **A** ora – channel proteins provide a, hydrophilic / water-filled, pathway (through the membrane) / AW **A** channel proteins are lined by polar R groups **A** ions are repelled by, hydrophobic core / phospholipid bilayer	**2**
4(c)	*any **three** from:* 1 transpiration (rate), will not decrease to a low level / remains the same (if conditions remain the same) / remain the same at night / increases if (named) condition(s) change / AW **;** 2 water vapour continues to diffuse out (from intercellular air spaces) **;** 3 (because) stomata, cannot close / remain open **;** 4 guard cells do not lose turgidity **;** 5 because no outward flow of water (from guard cells) **;** 6 by osmosis / down water potential gradient (from guard cells) **;** 7 AVP **;** e.g. *ref. to* more likely to wilt rates of gaseous exchange remain the same	**3**

Question	Answer	Marks
5(a)(i)	Morbillivirus **;**	**1**
5(a)(ii)	*any **three** from:* 1 (pathogen is transmitted) in airborne droplets / as an aerosol **;** **A** droplet infection / aerosol infection 2 breathed / sneezed / coughed / AW, out by infected person **;** 3 (droplets) breathed in by, healthy / uninfected, person **;** 4 touching surface with virus and, breathing into lungs / puts fingers in, nose / mouth **;**	**3**
5(b)	*any **three** from:* 1 increase and decrease / fluctuates / AW **;** **A** between 2015 and 2019, over some of the years or just one year **A** increase, decrease and then increase for any one year 2015 to 2018 2 use of data to support mp1 **;** 3 numbers for January 2019 are, highest / higher than other years **or** numbers for March 2019 are, lowest / lower than other years **;** 4 use of data to support mp3 **;**	**3**

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Question	Answer	Marks
5(c)	*ignore* mutation and vaccine evasion / vaccine resistance *ignore refs to cost* *any **four** from:* *transmission and susceptibility (from mp1 to mp7)* 1 infected person can infect many people / spreads easily in crowded conditions ; 2 measles spreads to children before they are vaccinated ; 3 vaccine cannot be given soon after birth because of passive immunity ; 4 immunisation rates do not reach 100% / ref to difficulty in reaching herd immunity / herd immunity is not achieved ; 5 herd immunity needed for protection of, unvaccinated people / babies ; 6 some people have, no / poor, response to vaccine ; **A** vaccine not always effective 7 *ref. to* malnutrition / *ref. to* lack of vitamin A ; *reasons for low immunisation rates (from mp8 to mp12)* 8 difficult to reach all people, with example ; e.g. in rural areas areas of poor housing in big cities 9 collapse of vaccination programmes as a result of war / AW ; 10 lack of, trained professionals / health facilities ; 11 many children do not receive boosters ; 12 reluctance to be vaccinated / *ref. to* anti-vaccination campaigns / ref to MMR *or* triple vaccine / lack of awareness about beneficial effects of vaccine / *ref. to* cultural *or* religious reasons / AW ; 13 AVP ; *(for either section of the answer)* e.g. *ref. to* any specific difficulty with contact tracing *ref. to* thermostability of vaccine and maintaining a cold chain migrants, with measles / from an area with an outbreak of measles	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>
<table>
<tr><th>feature</th><th>DNA</th><th>collagen</th></tr>
<tr><td>elements</td><td>C H O N P ;</td><td>CHON</td></tr>
<tr><td>monomers</td><td>(DNA) nucleotide(s) ;</td><td>amino acid(s) ;
ignore any named amino acid</td></tr>
<tr><td>bonds between monomers</td><td>phosphodiester ;</td><td>peptide ;</td></tr>
<tr><td>site of production in eukaryotic cells</td><td>nucleus</td><td>ribosomes / rough endoplasmic reticulum / RER / rough ER ;

A cytoplasm / Golgi (body / apparatus / complex)</td></tr>
</table>
</td><td>6</td></tr>
<tr><td>6(b)</td><td>*any **two** from:*

1 two membranes forming, nuclear envelope ;
A nuclear envelope is composed of a double membrane

2 nuclear pores too small to allow DNA to, pass through / escape ;
A ora

3 AVP ;
e.g. prevents DNA from being broken down (by enzymes)
I DNA damage by enzymes

protects DNA from hydrolytic enzymes
idea of nuclear envelope is a barrier, between / that separates, nucleus and, cytoplasm / rest of cell</td><td>2</td></tr>
</table>

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Question	Answer	Marks
6(c)	*any **two** from:* *either* 1 allow alveoli, to stretch and recoil (during inhalation and exhalation) **or** allow, lung (tissue) / named airway, to expand and recoil **;** **I** 'contract', 'relax' and 'gas exchange' / 'respiration' 2 prevent alveoli, over-stretching / bursting **;** 3 recoils to move air out of alveoli **;** **A** force / expel / push / AW **A** alveolar duct	**2**
6(d)	interphase / S (phase) / synthesis (phase) **;** **A** S1 / S2 **R** if 'interphase + G1 / G2' or 'S + G1 / G2'	**1**