Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **May/June 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 May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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

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Question	Answer	Marks
1(a)	**A** – ciliated, epithelium / epithelial tissue **;** **B** – smooth muscle **;** **D** – cartilage **;**	**3**
1(b)	**1** produce / release / secrete, mucus / mucin **;** **R** excrete mucus *any **two** from:* **2** mucus forms a layer over the (ciliated) epithelium **;** **3** traps / sticks to, bacteria / viruses / pathogens / microorganisms / dust / pollen / (fungal) spores / AW **;** **4** mucus is, moved / AW, away from alveoli *or* lung tissue / towards back of mouth / AW, by cilia **;** **R** 'by ciliated cells' **5** *idea that* mucus prevents (named) pathogens reaching, epithelial cells / alveoli / gas exchange surface **;** **A** acts as a barrier to (named) pathogens	**3**
1(c)(i)	*pH 7.7* = 72(%) *pH 7.4* = 60(%) **;**	**1**
1(c)(ii)	*allow Hb or hb for haemoglobin* decrease in supply of oxygen to tissues / AW **;** (at lower pCO_2 / increase pH blood) affinity of, haemoglobin, for oxygen is higher **or** haemoglobin is more saturated ora **A** less oxygen, released / dissociates / AW, from haemoglobin (than normal) *must be in context of higher affinity in the tissues* **or** data quote for difference in saturation of haemoglobin in correct range of pO_2 (within 2–6 $kPaO_2$) **;**	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>exocytosis ;</td><td>1</td></tr>
<tr><td>2(a)(ii)</td><td>one mark per row
<table>
<tr><th>cell structure in Fig. 2.1</th><th>name of cell structure</th><th>function of cell structure in plasma cell</th></tr>
<tr><td>P</td><td>nucleolus</td><td>production / assembly, of (sub-units of) ribosomes ;
A manufacture, ribosomal RNA / rRNA / transfer RNA / tRNA</td></tr>
<tr><td>Q</td><td>mitochondrion</td><td>R if answer refers to, ATP / energy, <u>for</u> aerobic respiration

<u>aerobic respiration</u> ;
A oxidative phosphorylation
A provide, ATP / energy
A produce / AW, <u>ATP</u></td></tr>
<tr><td>R</td><td>rough endoplasmic reticulum

R rough ER / RER / ribosome</td><td>protein / antibody, synthesis / transport ;
A synthesis of, polypeptide(s) / heavy and light chains
A (post-translational) modification of, polypeptide / protein / antibody
allow example
A forms (transport) vesicles</td></tr>
<tr><td>S</td><td>Golgi body

A Golgi, complex / apparatus</td><td>I lipids
(post-translational) modification of, polypeptide / protein / antibody
allow example
or
packaging, qualified ;
e.g. packaging of antibodies / protein, into vesicles

A formation of, vesicles / (primary) lysosomes</td></tr>
</table></td><td>4</td></tr>
</table>

Question	Answer	Marks
2(b)	*any **three** from:* **1** (named) small mammal, injected / AW, with antigen **;** **2** immune response occurs (over several weeks) **;** **A** immune response described **3** plasma cells / B-lymphocytes / B-cells / splenocytes, extracted from spleen **;** **4** plasma cells / activated B-lymphocytes / activated B-cells, <u>fused</u> with, myeloma / tumour / cancer / AW, cells (to form hybridomas) **;** **5** AVP **;** e.g. hybridoma cells separated (into wells) to produce clones screening / selection / AW, for hybridomas producing desired, (monoclonal) antibodies / Mabs *ref. to* large scale production	**3**
2(c)	*any **four** from:* **1** (artificial) <u>passive immunity</u> **;** **R** natural **2** no immune response **;** **I** primary / secondary **3** *idea that* antibodies are, broken down / degraded / destroyed (in the body / blood) **;** **R** 'antibodies die' **4** no long-term / only short-term / only temporary, immunity **;** **A** no formation of immunological memory **5** memory cells not produced **;** **A** memory cells only produced, in active immunity / during an immune response / after presentation of antigen **6** AVP **;** e.g. *ref. to* no, clonal selection / clonal expansion / antibodies produced	**4**

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Question	Answer	Marks
3(a)	**1** active site, shape / tertiary structure **;** **2** complementary to, substrate(s) / (intracellular) protein / ATP **;**	**2**
3(b)	*any **three** from:* **1** at low(er) concentrations / AW, of, substrate / ATP, lower rate of activity with GNF-5 **;** **2** as substrate concentration increases, effect of GNF-5 decreases **;** **3** maximum rate of reaction / V_{max} / described, is the same **;** **4** Michaelis-Menten constant / K_m, is higher with inhibitor **;** ora *accept comparative data quotes to support answers* *for ATP concentration, must use μmol dm^{-3} at least once*	**3**
3(c)(i)	*without inhibitor, activity of T315L* *any **one** from:* **1** no activity at 0.1 μmol dm^{-3} (ATP) **;** **2** maximum rate of reaction / V_{max}, is reached / AW, (for T315L) at a higher concentration (of ATP) **;** **3** Michaelis-Menten constant / K_m, is higher (for T315L) **;** ora *accept comparative data quotes to support answers* *for ATP concentration, must use μmol dm^{-3} at least once*	**1**
3(c)(ii)	*with inhibitor, activity of T315L* *any **two** from:* **1** activity does not reach TKR, maximum rate of reaction / V_{max} **;** **2** *idea that* drug / GNF-5, acts as a non-competitive inhibitor of T315L **;** **3** drug / GNF-5, has less of an effect at low concentrations on activity (of enzyme / T315L) **;** ora *accept comparative data quotes to support answers*	**2**

Question	Answer	Marks
4(a)(i)	ester **;**	**1**
4(a)(ii)	condensation **;**	**1**
4(a)(iii)	**1** (hydrocarbon chains of) different lengths / **Y** is longest / **Z** is shortest **;** **A** correct numbers of carbon atoms in each fatty acid (**X** 18, **Y** 20 and **Z** 16) *if no ref. to different lengths* **2** **Z** saturated, **X** and **Y** unsaturated **;** **A** only Z is saturated **3** **X** polyunsaturated, **Y** monounsaturated **;** **4** **X** 3, **Y** 1, **Z** 0 double (C=C) bonds **; only Z** only has single / C-C) bonds **or** (for whole molecule) **X** 4 double bonds , **Y** 2 double bonds, **Z** 1 double bond **;**	**3**
4(b)(i)	*any **two** from:* **1** (hydrocarbon / fatty acid tails, are) non-polar / have no polar groups **/** not charged **;** **A** equal sharing of electrons in molecule **2** not soluble / insoluble, (in water) **;** **3** cannot form hydrogen bonds with water **;** **I** repel water	**2**
4(b)(ii)	*any **two** from:* **1** no, hydrophilic / polar / phosphate, head / part, to, interact with / AW, water **;** **I** triglycerides are hydrophobic **2** cannot form hydrogen bonds with water **;** **I** repel water **3** cannot form a bilayer **;** in water triglycerides, form micelles / form spheres / ball shaped / form globules / do not form thin films / AW **;**	**2**

Question	Answer	Marks
5(a)	(pathogen / causative organism is) transferred / passed on / AW, (from infected) to an uninfected, person / organism **;** **I** disease **I** from one person to another *unqualified* **I** spread	**1**
5(b)	*any **two** from* *information needed* **1** magnification of, image / (electron) micrograph / Fig. 5.1 **;** **A** scale bar **I** magnification of (electron) microscope **2** length of flagellum (in, image / Fig. 5.1) **;** **I** width / diameter / size **3** *formula* actual length of flagellum = measured length of flagellum divided by magnification **;** **A** A= I / M **or** magnification triangle	**2**
5(c)(i)	0.2	**1**

Question	Answer	Marks
5(c)(ii)	*large outbreaks of cholera in countries shown in Table 5.1 accept ora* *any **five** from:* **I** *ref. to* poverty, unqualified **1** civil disturbance / (civil) war **;** **2** named natural disaster **;** **I** famine / drought **3** lack of, uncontaminated / AW, drinking water **;** **A** examples e.g. no piped water supply / no bottled water / no water treatment **4** *ref. to* sewage, qualified **;** e.g. no sewage treatment **A** examples e.g. no separation of drainage from homes and water supplies / contamination of water supplies with human faeces **5** poor sanitation **;** *credit only if mp3 or mp4 are not awarded* **6** *ref. to* poor personal hygiene / described example **;** **7** eating contaminated foods **;** e.g. crops irrigated with contaminated water / seafood harvested from contaminated seawater **8** slow(er) / no / little, diagnosis **;** **9** slow(er) / no / little, treatment / healthcare / medical facilities **;** **10** <u>oral</u> rehydration, (salts / therapy), not, provided / available **;** **A** named example of oral rehydration **11** antibiotics not, provided / available **;** **12** vaccine not provided / vaccine not available / reluctance to be vaccinated / ref to anti-vaccination campaigns **;** **13** poor, understanding of / education about, prevention / treatment / precautions **;** **14** AVP **;** e.g. difficult to reach people living in, rural / remote / dangerous, areas lack of trained professionals antibiotic resistance *ref. to* people bringing in cholera from elsewhere	**5**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>one mark each correct row

<table>
<tr><th>feature</th><th>mRNA</th><th>DNA</th></tr>
<tr><td>names of four bases</td><td>adenine, cytosine, guanine, uracil</td><td>adenine, cytosine, guanine, thymine ;</td></tr>
<tr><td>name of pentose sugar present</td><td>ribose</td><td>deoxyribose ;</td></tr>
<tr><td>number of strands</td><td>1 ;
I single</td><td>2 ;
I double</td></tr>
</table></td><td>3</td></tr>
<tr><td>6(b)(i)</td><td>transcription ;</td><td>1</td></tr>
<tr><td>6(b)(ii)</td><td>can award either mp1 with mp2 ,or mp3 with mp4

1 removal of introns (from primary transcript / RNA) ;
2 exons joined together ;

or

3 splicing ;
4 of, primary transcript / RNA ;</td><td>2</td></tr>
</table>

Question	Answer	Marks
6(c)(i)	*any **four** from:* **1** *ref. to* amino acid activation / charging amino acids before attachment to tRNA / AW **;** **A** aminoacylation **2** tRNA attached to, specific amino acid / glycine **;** **R** 'picks up' **3** *idea that* anticodon / CCG, identifies specific amino acid **;** **4** tRNA transports / AW, amino acid to ribosome **;** **5** *ref. to* (tRNA) entering the A (aminoacyl) site in ribosome **;** **6** tRNA, anticodon / CCG, binds to mRNA, codon / GGC ; **A** correct ref. to, complementary pairing / base pairing / H bond formation *as AW for binding* **7** (specific) amino acid / glycine, in correct position in the polypeptide chain / AW **;** **A** helps to form / AW, primary structure of cotransporter protein **8** AVP **;** e.g. tRNA, recycled / reused forms aminoacyl tRNA / amino acid-tRNA complex tRNA-ligase / aminoacyl-tRNA synthetase	**4**
6(c)(ii)	*any **three** from:* **1** movement of sucrose with, protons / H^+ ions, into companion cells **;** **A** correct *ref. to* (other named) assimilates **2** (sucrose moved) from, apoplast / cell wall / mesophyll cell **;** **3** sucrose moves against its concentration gradient (into companion cell) **;** **4** (needs cotransporter protein because) sucrose is polar so cannot pass through membrane **;** **5** maintain concentration gradient for sucrose between companion cell and sieve tube (element) **;**	**3**

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