Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

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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PUBLISHED

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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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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Examples of how to apply the list rule
State **three** reasons…. [3]

A

1 Correct	✓	**2**
2 Correct	✓	
3 Wrong	×	

B **(4 responses)**

1 Correct, Correct	✓, ✓	**3**
2 Correct	✓	
3 Wrong	ignore	

C **(4 responses)**

1 Correct	✓	**2**
2 Correct, Wrong	✓, ×	
3 Correct	ignore	

D **(4 responses)**

1 Correct	✓	**2**
2 Correct, CON (of 2)	×, (discount 2)	
3 Correct	✓	

E **(4 responses)**

1 Correct	✓	**3**
2 Correct	✓	
3 Correct, Wrong	✓	

F **(4 responses)**

1 Correct	✓	**2**
2 Correct	✓	
3 Correct CON (of 3)	× (discount 3)	

G **(5 responses)**

1 Correct	✓	**3**
2 Correct	✓	
3 Correct Correct CON (of 4)	✓ ignore ignore	

H **(4 responses)**

1 Correct	✓	**2**
2 Correct	×	
3 CON (of 2) Correct	(discount 2) ✓	

I **(4 responses)**

1 Correct	✓	**2**
2 Correct	×	
3 Correct CON (of 2)	✓ (discount 2)	

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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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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>bronchi ; A bronchus</td><td>1</td></tr>
<tr><td>1(b)</td><td>any two from:
trachea v alveoli
<table>
<tr><td>trachea</td><td></td><td>alveoli</td></tr>
<tr><td>(carries) oxygenated blood
A (carries) blood with more oxygen</td><td>or</td><td>(carries) deoxygenated blood ;
A described
A (carries) blood with, less / little, oxygen
I no oxygen</td></tr>
<tr><td>lower concentration of carbon dioxide</td><td>or</td><td>higher concentration of carbon dioxide ;</td></tr>
<tr><td>blood at higher pressure</td><td>or</td><td>blood at lower pressure ;</td></tr>
<tr><td>(part of the) systemic circulation
or
branch from the aorta / (originates) from, left ventricle</td><td>v</td><td>(part of the) pulmonary circulation
or
pulmonary artery
or
from right ventricle (of heart) ;</td></tr>
</table></td><td>2</td></tr>
</table>

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Question	Answer	Marks
1(c)(i)	*allow from, labelled / annotated, diagrams drawn* *any **three** from:* ciliated epithelium / ciliated epithelial cells / ciliated cells / cells with cilia **;** detail (of ciliated epithelial cells) **;** e.g. columnar / description cilia, only facing the lumen / on apical lumen / lining the lumen **I** on surface of tissue goblet cells **;** AVP **;** e.g. basement membrane pseudostratified (epithelium) large nuclei **I** visible / clear, nuclei basal nuclei (in goblet cells) nucleoli visible within nuclei	**3**

Question	Answer	Marks
1(c)(ii)	blood vessel / capillary / venule **;** *plus two from:* presence of red blood cells (in the lumen) **;** endothelium / endothelial cells **;** **A** flat cells *accept for endothelial cell* **A** cells with, prominent / bulging / AW, nucleus very thin / one cell thick, walls **;** *ref. to* small size, qualified **;** e.g. narrow lumen / comparison to other tissues *alternative* endothelium / endothelial cell **;** *plus two from* flat cells **;** cells with, prominent / bulging / AW, nucleus **;** one cell thick **;**	**3**

Question	Answer	Marks
2(a)	peptidoglycan / murein **;** ribosomes **;** (permanent / large) vacuole **;**	**3**
2(b)	*any **two** from:* to prevent, lysis / bursting / AW **or** to prevent, (protoplast) shrinking / shrivelling / AW **;** **I** damaged *ref. to* no net movement / AW, of water (occurs) **;** (otherwise movement of water) by <u>osmosis</u> / down a water potential gradient / AW **;**	**2**

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Question	Answer	Marks
2(c)(i)	*max 2 if stated as a protein or includes protein features* *any **three** from:* *cellulose molecule max 2* (β-glucose(s) joined by) glycosidic / glucosidic, bonds / linkages **;** (monomers / β-glucose(s)) joined by (β) 1,4 (glycosidic) bonds **;** **R** α-1,4 bonds **R** (β)1,4 <u>and</u> 1,6 bonds adjacent, monomers / β-glucoses, rotated through 180° **;** AW straight / linear, chain **;** *cellulose microfibril max 2* parallel, molecules / chains, of cellulose **;** hydrogen bonds, between molecules / form cross bridges / between OH groups **;** *idea that* between adjacent cellulose molecules, beginnings and ends in different places / overlap between starts and ends / staggered starts and ends **;**	**3**
2(c)(ii)	*any **one** from:* hemicellulose **;** pectin **;** lignin **;** AVP **;** e.g. expansin	**1**
2(d)	spongy mesophyll / palisade mesophyll / palisade / mesophyll, (cell) **;**	**1**

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Question	Answer	Marks
3(a)	*any **three** from:* decreases / reduces, transpiration **;** **A** lower transpiration rate *accept in the correct context once only* *counts towards max two* **I** evaporation *max two for cuticle* thick (waxy) cuticle **;** increased waterproof layer **;** increased (diffusion) distance for water vapour / less water vapour lost **;** *in context of cuticular transpiration* *max two for stoma* sunken stoma **;** **A** stoma in depression / AW moist / humid, air collects in area near to external environment **;** AW decreases water potential gradient **;** *in context of between sub-stomatal air space or area above stoma and external environment* *alternative acceptable statement for the transpiration mark* reduces diffusion of water vapour (out) via the stoma **;**	**3**
3(b)(i)	*any **three** from:* (many) mitotic cell cycles / mitoses **;** AW *ref. to* division of (meri)stem cell also produces more (meri)stem cells **;** formation of rootlets by mitosis is, growth / increase in number of cells **;** *idea of producing large number of cells* **R** cell growth differentiation / specialisation **;** *in context of the new cells formed by stem cell division*	**3**

Question	Answer	Marks
3(b)(ii)	*any **three** from:* active transport occurring **;** (pumped / moved, out) against the(ir) concentration gradient **;** (move out through), carrier / pump, protein **;** **R** channel protein using, ATP / energy **;** **A** have ATPase activity AVP **;** e.g. membrane impermeable to entry of anions suggestion that move out by exocytosis *allow ATP mp if also stated*;	**3**
3(b)(iii)	*any **two** from:* increased surface area **;** (because, many / more) root hairs / root hair cells **;** increase in, carrier proteins / channel proteins (for ion uptake) **;** **A** transport proteins / aquaporins (for water) **R** channel proteins AVP **;** increase in water uptake osmotically to follow ion uptake / AW **;**	**2**

Question	Answer	Marks
4(a)	<u>image length</u> **;** **A** magnification triangle magnification 250 (nm) **;** (8 mm) **A** 220 (for 7 mm) **A** 230 (for 7.5 mm) **A** 270 (for 8.5 mm) **A** 280 (for 9 mm)	**2**
4(b)	pathogen **;**	**1**

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Question	Answer	Marks
4(c)	ingests / drinks / AW, contaminated water / water containing the pathogen / food washed in contaminated water **/** contaminated food **;** **A** examples of accidental ingestion e.g. swimming in contaminated rivers **A** faecal / oral, transmission **A** bacteria / *Vibrio* **R** if described as virus	**1**
4(d)	**A** mRNA or messenger RNA *any **three** from:* (one strand only needed) to form mRNA / mRNA is single-stranded **;** (m)RNA is, used / needed, to produce, subunit (s) / polypeptide(s) **;** (only) one strand (of DNA) is the, template / transcribed, strand **;** *idea that* (complementary) copying / transcribing, other DNA strand would not result in, desired / AW, mRNA / polypeptide **;**	**3**
4(e)(i)	*any **two** from:* **I** receptor **I** active site (mAbs) specific / different, antigen binding sites / binding sites for antigen **;** **A** (each) mAb binds to a, specific / particular, antigen **R** if antibody described as an enzyme (each mAb has) specific / different, tertiary structure / variable region(s) / primary structure / sequence of amino acids **;** binding site and antigen have complementary shapes **or** ZAC-3 complementary shape to core polysaccharide and lipid A **or** 2D6 complementary shape to O-polysaccharide **;**	**2**

Question	Answer	Marks
4(e)(ii)	*any **four** from:* *yes* *general points* *(agglutination / motility prevented, so)* bacteria less able to, penetrate mucus / attach to intestinal epithelial cells / colonise intestine / AW **;** **A** *idea that* fewer bacteria able to, attach / colonise intestine less / no, choleragen / toxin, released **;** bacteria passed out in faeces not able to cause disease in others / AW **;** *ref. to* phagocytosis more effective **;** e.g. macrophages stimulated to carry out phagocytosis *prevention / treatment* (to prevent disease) needs to be given, at early stages / before colonising (intestine) **;** passive immunity / passive vaccine **;** *must be in context of treatment or immediate protection* *idea that* in addition to immune response (so increased effect) **;** e.g. acts beside, immune system / immune system cells acts before the immune response can become effective *ref. to* quicker recovery (if a person has cholera) **;** useful when, there is antibiotic resistance / antibiotics cannot be given **;** *specific mAb* mAb ZAC-3 may be more effective for cholera caused by, wider range of *V. cholerae* / AW**;** mAb ZAC-3 may be useful if exact form of *V. cholerae* not known **;** mAb 2D6, needs to be targeted against specific *V. cholerae* forms / may not be effective against other *V. cholerae* forms **;** **A** not all forms of *V. cholerae* were tested in lab	**4**

Question	Answer	Marks
4(e)(ii)	AVP **;** e.g. (only) short-term protection / not active immunity / not long term ref. difficulty in delivering mAbs to intestine e.g. may be, digested / destroyed, as pass through gut need to find a way to get mAbs to the intestine if given intravenously need to pass through to gut lumen may be able to prevent multiplication of bacteria mAbs have been used successfully for other diseases	

Question	Answer	Marks
5(a)	*any **two** from:* *ref. to* can organise / order, enzymes / events, in pathway **;** consequence in terms of distance **;** e.g. product of one reaction is close to next enzyme (where it acts as substrate) enzyme (more likely to be) closer to substrate distance between enzymes shorter **I** short distance / less distance to travel, unqualified (so) increases chance of successful collisions between substrate and enzymes **;** increased rate of formation of final product **or** decrease time for ES complex to occur **;** *idea that* products can pass to either side of the membrane **;** all reactions, localised / occur in the same location (within the cell) **;** AVP **;** e.g. membrane provides a source of arachidonic acid **I** phospholipid	**2**
5(b)(i)	(similar shaped) curve to the right of main curve <u>and</u> reaches V_{max} **;** **A** increasing to reach V_{max}	**1**

Question	Answer	Marks
5(b)(ii)	stays the same **;** increases **;**	**2**
5(c)(i)	the gene / PTGS2, is a sequence of nucleotides, that forms part of a DNA molecule / AW / on chromosome 1 **;** **A** bases codes for (the production of) a, polypeptide / enzyme / COX-2 **;** **A** protein **I** codes for an amino acid *max one if no example used*	**2**
5(c)(ii)	*any **two** from:* more, product / compounds, produced that stimulate mitosis **;** increased, DNA replication / cell division / mitosis **;** **I** *ref. to* cancer cells replicating *idea that,* may lead to / increases chance of / AW, (other) mutations **;** mutations can result in oncogenes **;** AVP **;** e.g. *idea that* proof checking capacity impaired / increased chance of errors	**2**

Question	Answer	Marks
5(d)	*any **three** from:* phospholipids may be, used in / added to, the (cell surface) membrane **;** arachidonic acid, is unsaturated / polyunsaturated **;** has, C=C / (carbon-carbon) double bonds **;** *allow ecf if stated as saturated* unsaturated fatty acid tails, have kinks / not linear / AW **;** **A** double bonds produce, kinks / AW increased distance between, phospholipids / other fatty acid tails **;** **A** phospholipids cannot pack closely together less hydrophobic interactions between phospholipid (molecules) **;**	**3**

Question	Answer	Marks
6(a)	wall / muscle, of right atrium **;**	**1**
6(b)	atrial, systole / contraction **;**	**1**
6(c)	AVN delays impulse (from sinoatrial node / atrial muscle) **;** AW e.g. excitation wave / conduction *plus one from:* ring of non-conducting fibrous tissue prevents impulse from sinoatrial node directly passing to ventricles **;** impulse must pass through, atrioventricular node / AVN **;** (then) passes to Purkyne tissue (to ventricles for contraction) **;**	**2**
6(d)	semi-lunar (valves) **;** **A** aortic valve <u>and</u> pulmonary valve	**1**

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