Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **February/March 2023**

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 2023 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

© UCLES 2023

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.

© UCLES 2023

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	<u>'List rule' guidance</u> 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.

© UCLES 2023

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:

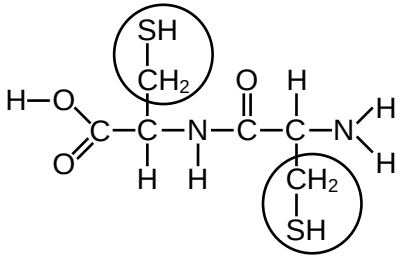
;	separates marking points
/	alternative answers for the same marking point
R	reject
A	accept
I	ignore
AVP	any valid point
AW	alternative wording (where responses vary more than normal)
ecf	error carried forward
underline	actual word underlined must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point

© UCLES 2023

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>cell structure</th><th>eukaryotic cells</th><th>prokaryotic cells</th></tr>
<tr><td>nucleus</td><td>✓</td><td>×</td></tr>
<tr><td>Golgi body</td><td>✓</td><td>×</td></tr>
<tr><td>circular DNA</td><td>✓</td><td>✓</td></tr>
<tr><td>70S ribosome</td><td>✓</td><td>✓</td></tr>
</table>
one mark for each correct column ; ;</td><td>2</td></tr>
<tr><td>1(b)</td><td>diagram showing:

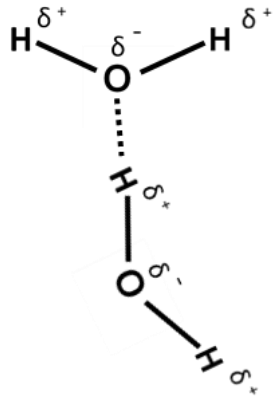
dark line(s) labelled as phosphate heads ;
A phospholipid heads
clear area(s) between pairs of dark lines labelled as, fatty acid tails / hydrocarbon chains / hydrophobic core / AW ;
R if pointing to intercellular space
clear area between the two cell surface membranes labelled as, interstitial fluid / tissue fluid / extracellular matrix / intercellular space ;
A intercellular, area / region</td><td>3</td></tr>
</table>

Question	Answer	Marks
1(c)(i)	*G_1 phase:* *any **one** from:* RNA, synthesised / transcribed / translated **;** proteins / enzymes, synthesised **;** increasing quantity of organelles **;** increase in volume of cytoplasm **;** **A** growth (at end of G_1 phase) checkpoint passed for dividing or not **;** *S phase:* *any **one** from:* DNA (semi-conservative) replication **;** doubles, mass ***/*** number of strands, of DNA **;** ref. to each chromosome now comprises two chromatids **;**	**2**
1(c)(ii)	*any **one** from:* uncontrolled / increased, cell division ***/*** mitosis **;** resting cells could enter mitosis **;** more cells move from the G_1 to the S phase **;**	**1**

Question	Answer	Marks
2(a)	either **R** group circled **;** 	**1**
2(b)(i)	disulfide (bonds) **;**	**1**
2(b)(ii)	exocytosis **;** *plus any **two** from:* **either:** (idea of) vesicles will be large enough to contain many mucins ***/*** ref. to bulk transport **;** vesicles forming from Golgi, body / apparatus **;** vesicles moved by microtubules / cytoskeleton (to cell surface membrane) **;** vesicles fuse with cell surface membrane **;** active process ***/*** requires ATP **;** AVP **;** e.g. mucins are, polar / hydrophilic**,** so cannot cross, phospholipid bilayer ***/*** hydrophobic core of membrane **or:** mucin molecules are hydrophilic **;** can exit via protein channels **;** by facilitated diffusion **;**	**3**
2(c)	*any **two** from:* (because mucus is too thick) cilia, have difficulty / AW, moving the mucus (upwards) **;** pathogens, build up / not removed / AW **;** more chance of, infection / disease **;** AVP **;**	**2**

Question	Answer	Marks
2(d)(i)	deletion **;**	**1**
2(d)(ii)	transcribed **/** template **;** **R** transcription strand **I** anti-sense / coding, strand	**1**
2(d)(iii)	AUC AUU GGU GUU **;**	**1**
2(d)(iv)	*any **three** from:* 1 idea of 3 bases coding for 1 amino acid **;** 2 introns removed from, primary transcript RNA **/** AW **;** **A** gene splicing / RNA splicing **A** mRNA does not contain introns **R** if not in correct context (primary transcript to mRNA) 3 introns **/** non-coding DNA, do not code for amino acids **;** 4 (only) exons are joined together (to form mRNA) **;** 5 DNA triplet / mRNA codon, for STOP does not code for an amino acid **;** 6 methionine at start / first amino acid / amino acid coded for by START codon, removed **;** 7 AVP **;** e.g. ref. to (upstream) enhancer sequences ref. to (downstream) terminator sequences ref. to (non-coding) regulatory sequences / promoter	**3**

Question	Answer	Marks
3(a)(i)	cell **Y** shows, a sieve plate / sieve pores **; ora** idea that the sieve plates are at different heights in the stem **/** the section misses the sieve plate in cell **X /** AW **;**	**2**
3(a)(ii)	*any **four** from:* 1 (protein in) companion cell surface membrane, moves / pumps, protons into, cell wall **/** apoplast **;** 2 using ATP / by active transport **;** 3 establishes a proton gradient **;** 4 protons move into companion cell, by facilitated diffusion **;** **A** described e.g. down the, electrochemical / concentration, gradient 5 protons cotransport sucrose / protons and sucrose pass through a cotransporter (protein), into companion cell **;** 6 sucrose moves against its concentration gradient **;** 7 diffusion of sucrose into phloem sieve tube, through plasmodesmata **;** **A** all marking points from an annotated diagram	**4**

Question	Answer	Marks
3(b)(i)	this could be answered diagrammatically or in text, e.g.  *any **two** from:* *idea that* oxygen has a small negative charge and hydrogen has a small positive charge **;** *idea that* a hydrogen bond forms between the oxygen of one water molecule and the hydrogen of a neighbouring water molecule **;** AVP **;** e.g. oxygen is more electronegative than hydrogen	**2**
3(b)(ii)	*any **three** from:* 1 ref. to cohesion between water molecules **;** 2 ref. to adhesion / hydrogen bonding, between water molecules and, cellulose / hydrophilic parts of lignin (in cell wall) **;** **A** hydrophilic parts of cell wall 3 formation of continuous column / AW **;** 4 (column) pulled up by, transpiration / evaporation / transpiration pull **;**	**3**

Question	Answer	Marks
3(b)(iii)	*any **two** from:* ref. to plant leaves heat up, when light absorbed for photosynthesis / at high (ambient) temperatures **;** (high latent heat of vaporisation leads to large cooling effect / removal of (large quantities of) heat energy, by evaporation **;** reduces, protein / enzyme, denaturation **;** reduces rate of water loss by, transpiration / evaporation, at high temperatures **;** AVP **;**	**2**

Question	Answer	Marks
4(a)(i)	caused by pathogens **;** is transmissible **/** AW **;**	**2**
4(a)(ii)	*Mycobacterium tuberculosis* / *Mycobacterium bovis* **;**	**1**
4(b)	natural **and** passive **;**	**1**
4(c)	*any **three** from:* 1 (as influenza virus mutates) antigen (proteins) altered / altered capsid proteins / AW **;** 2 antibodies are specific to antigens **;** 3 ref. to complementary shape (between variable regions of antibody and antigen) **;** 4 ref. to variable regions / Fab, at the ends **;**	**3**
4(d)(i)	*for children, allow people* *for polio allow disease* *any **three** from:* 1 ref. to vaccination programme aims to vaccinate, whole populations / large numbers **;** 2 vaccine allows (most), children / people, to have an immune response (against antigens of the disease organism) **;** 3 develop, long-term immunity **/** artificial active immunity / memory cells against, polio / disease **;** 4 *idea that* vaccinated individuals cannot, transmit virus / transmit polio / infect others **;** 5 herd immunity / described **;** 6 AVP **;** e.g. ref. to vaccination programme aims to break the transmission cycle	**3**

Question	Answer	Marks
4(d)(ii)	*any **one** from:* penicillin only acts on, bacteria / prokaryotes **;** virus does not have, cell walls / murein / peptidoglycan **;** virus does not have, transpeptidases / the enzyme that is, inhibited / acted on, by penicillin **;** virus does not grow / penicillin (only) acts on growing cells / AW **;** **A** when cell wall is, growing (larger) for growing cells virus does not have cellular structure / virus is acellular **;**	**1**

Question	Answer	Marks
5(a)	line drawn from right atrium to the arrow into the pump **and** line drawn from the arrow out of the heater back to the (inferior / superior) vena cava **;**	**1**
5(b)(i)	alveolar wall / alveolar epithelium **;** **A** alveolus / alveoli **A** wall of air sacs	**1**
5(b)(ii)	*any **three** from:* oxygen moves (from the oxygen-enriched air) into the blood **and** carbon dioxide moves from the blood (into the oxygen-enriched air) / AW **;** by diffusion / down their concentration gradients **;** (opposite flow arrangement / counter current) maintains a steep diffusion gradient **/** ref. to equilibrium is not reached **/** AW **;** short diffusion pathway (across the membrane) **;** AVP **;** e.g. oxygenator membrane (will have a) large surface area	**3**

Question	Answer	Marks
5(c)	(the tunica media of aorta) contains, more elastin / more elastic fibres / more elastic tissue / less smooth muscle, than the muscular artery **; ora** *plus any **two** from:* allows the aorta to stretch / aorta less likely to burst (as a result of high blood pressure) **;** during ventricular contraction **/** systole **;** (after stretching) the aorta recoils **;** maintains high blood pressure **;** evens out the flow of blood / AW **;**	**3**
5(d)(i)	for speeding up / as enzyme for / for catalysing, conversion of (water and) carbon dioxide to, carbonic acid / hydrogencarbonate ions **;**	**1**
5(d)(ii)	hydrogencarbonate ions do not leave the red blood cells so no charge imbalance / AW **;**	**1**

© UCLES 2023

Question	Answer	Marks
6(a)	*any **three** from:* covalent bonds between collagen molecules (between R groups / side-chains) **;** covalent bonds are strong **;** (molecules) staggered / overlapping molecules, so no weak areas **(**gives greater strength) **;** (in skin) fibres line up in layers**,** not parallel / running in different directions **;** provides tensile strength / strength in different directions **;**	**3**
6(b)	*any **two** from:* *at pH 8.0:* ionic / hydrogen bonds**,** (between R groups) broken / altered **;** active site shape altered **;** (active site) no longer / less**,** complementary to substrate ***/*** collagen **or** fewer enzyme–substrate complexes formed **;** AVP **;** e.g. the amino acids in the active site affected by the changing pH ref. to partial denaturation	**2**

© UCLES 2023