Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/21**

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

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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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;	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)	**A** mitochondrion **;** **B** rough endoplasmic reticulum **; A** ribosome / 80S ribosome	**2**
1(a)(ii)	*any **three** from:* (more efficient) synthesis / metabolism / AW, of named product **;** e.g. lipid / named lipid phospholipid steroid / steroid hormone / named, e.g. oestrogen / testosterone sterol / cholesterol **I** ref. to storage other function **;** e.g. detoxification *max **two** from:* *idea that* synthesis of products / AW, is a pathway / requires more than one enzyme **;** further detail **;** e.g. enzymes of same pathway are, close together / in clusters products of one reaction are substrates of the next *suggestion that* membrane gives enzymes, more stability / greater protection (from degradation) **;** AVP **;** e.g. *idea of* greater efficiency as enzyme held so that active site faces substrates in lumen *suggestion that* allows reactions to occur on cytoplasmic side of membrane *suggestion that* allows reaction to continue / complete, in SER transport vesicles	**3**

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Question	Answer	Marks
1(b)	*any **three** from:* higher magnification (without loss of detail) **;** higher resolution / ability to see object that are close together as separate objects **;** *ref. to* resolution of (up to) 0.5 nm compared to, 200 nm / 0.2 µm (light microscope) **;** **A** ranges, e.g. 0.5–30 nm and 100–300 nm ability to see organelles such as, SER / ribosomes / other named organelle **;** AVP **;** e.g. very thin sections, qualified, e.g. for greater internal detail	**3**

Question	Answer	Marks
2(a)(i)	*closed circulation because* blood is contained within blood vessels **;** *double circulation because* blood flows through the heart twice for one complete, circuit of the body / circulation **;** **A** described **A** pulmonary circulation **and** systemic circulation	**2**
2(a)(ii)	**Q** = vena cava **and** **R** = aorta **;**	**1**

Question	Answer	Marks
2(a)(iii)	**I** *ref to* valves *any **three** from:* ***Q** has a*: thinner wall **;** **A** thinner middle layer wider lumen relative to thickness of wall **;** thinner tunica media **;** (proportionately) less smooth muscle **;** (proportionately) less / very few, elastic fibres **;** *allow* ecf from Q2(a)(ii)	**3**
2(b)(i)	human antibodies, are made of four polypeptides / contain two light chains **and** two heavy chains **;**	**1**
2(b)(ii)	*any **two** from:* more / easier to, pass through gaps in, capillary wall / endothelium **;** (so) more enter tissue fluid (surrounding tumour cells) **;** *idea of* more cancer cells destroyed quickly **;** (smaller so) may not trigger an immune response **;** AVP **;** e.g. easier to, diffuse / move, through tumour to reach, more / all, cells binds more tightly to antigens on (cancer) cell surface(s) *suggestion that* makes macrophage response stronger smaller overall size even when drugs attached	**2**

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Question	Answer	Marks
2(b)(iii)	*any **three** from:* gives (artificial) passive immunity **;** fast acting / quick response / time not needed for immune response **;** antibody binds to (non-self / foreign) antigen (on surface of a pathogen) **;** antibodies bind to toxins, neutralising them / AW **or** antibodies act as antitoxins **;** ref phagocytosis **;** AVP **;** e.g. opsonisation bind to flagella and immobilise pathogen antibodies cause, agglutination / clumping / AW, of pathogen	**3**

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Question	Answer	Marks
3(a)(i)	*any **two** from:* spherical / ball shaped **;** (water-) soluble **;** amino acids with hydrophilic R groups / hydrophilic amino acids, on outside of molecule **;** **A** amino acids with hydrophobic R groups in centre of molecule physiological / metabolic, role **;** carbonic anhydrase is an enzyme, (enzymes are globular proteins) **;**	**2**
3(a)(ii)	*any **two** from:* catalyses / AW, reaction between water and carbon dioxide **;** (to form) carbonic acid **;** catalyses formation of carbon dioxide and water from carbonic acid in lungs **;**	**2**
3(b)(i)	guanine **;** *any **two** from:* double ring (base) / purine (base) **;** forms three hydrogen bonds with complementary base **;** AVP **;** e.g. detail of difference between adenine and guanine	**3**

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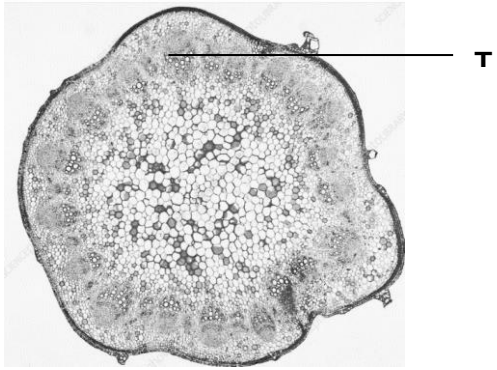
Question	Answer	Marks
3(b)(ii)	*any **four** from:* three bases / triplet of bases / codon, code(s) for one amino acid **;** frameshift mutation **;** change in, triplet of bases / codon **;** *ref. to* every, triplet / codon, after deletion will be different **;** may introduce a stop codon **;** primary structure / sequence of amino acids / AW, will be altered **;** (stop codon results in) formation of, shortened / truncated, polypeptide **;** AVP **;** e.g. *ref. to* errors in RNA splicing *ref. to* affects post-translational modification bonds that form between R groups, will / may, be altered tertiary structure of protein will be altered non-functional protein formed altered function of the protein	**4**
3(b)(iii)	*any **one** valid suggestion e.g.:* no effect on protein structure (because introns are non-coding) **;** non-functional / reduced function of, protein (as intron not spliced after transcription) **;** may affect regulation of gene expression **;** **A** example e.g. reduction in the rate of transcription RNA polymerase does not bind *ref. to* errors in RNA splicing **;** *ref. to* formation of an oncogene **;**	**1**

Question	Answer	Marks
4(a)(i)	no, nucleic acid / genetic material / DNA / RNA **;** no, capsid / protein coat **; A** no capsomeres only some viruses have envelopes **;**	**2**
4(a)(ii)	heads / phosphate, (groups) of phospholipids are hydrophilic **or** fatty acid tails of phospholipids are hydrophobic **;** **A** heads are hydrophilic and tails are hydrophobic heads / phosphates, point towards the centre (of the virosome so, must be aqueous / water present) **; ora** *for tails*	**2**
4(b)	*any **two** from:* acts as a non-self / foreign, antigen **;** triggers / stimulates, primary immune response **or** provides (artificial) active immunity **;** (leads to) formation of antigen presenting cell **;** **A** endocytosis / phagocytosis, to present antigen (by, macrophage neutrophil) activates, B lymphocytes / T lymphocytes **;** **A** clonal selection formation of memory cells **;**	**2**
4(c)	*any **two** from:* no change in, shape / tertiary structure / conformation, of active site **; ora** (same) substrate able to bind to active site **; ora** consequence **;** e.g. so viruses can leave host cell to infect other cells the mutation is not occurring in the, gene / section of gene coding for amino acids in active site for neuraminidase **;** the gene for neuraminidase is essential for survival **;** AVP **;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>one mark for named pathways ;
one mark for outline of apoplastic pathway ;

<table>
<tr><th>name of pathway</th><th>outline of pathway</th></tr>
<tr><td>symplast / symplastic</td><td>movement of water from cell to cell via plasmodesmata</td></tr>
<tr><td>apoplast / apoplastic</td><td>movement of water via, cell walls / intercellular spaces</td></tr>
</table></td><td>2</td></tr>
<tr><td>5(b)</td><td>label line labelled T to any area of xylem tissue ;
e.g.


</td><td>1</td></tr>
</table>

Question	Answer	Marks
5(c)(i)	lysosome **;**	**1**
5(c)(i)i	*any **three** from:* increased permeability to water **;** increased, aquaporins / protein channels (in the tonoplast) **;** water potential in vacuole is lower than that of cytoplasm **;** **A** more ions in vacuole lower water potential more water enters (vacuole) by osmosis **;** vacuole increases, in volume / pressure (until it bursts) **;** AVP **;** e.g. fewer transport proteins for exit of ions	**3**
5(c)(iii)	*allow two suggestions or a suggestion with further detail, for two marks* active site becomes complementary to substrate **;** (because) bonds altered between R groups of amino acids **;** **A** hydrogen / ionic, bonds removal of a portion that blocks the active site **;** AW substrate can enter active site **;** *idea of* cofactor / AW, associates with the enzyme **;** enzymes becomes functional **;** sets off an enzyme cascade / ref. cell signalling **;** AVP **;**	**2**

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Question	Answer	Marks
5(d)(i)	*any **two** from:* caused by a pathogen **;** *idea that* it is transmissible / passed from infected plant to uninfected plant **;** results in harm being caused / AW **;**	**2**
5(d)(ii)	protoctist **;** <u>*Plasmodium falciparum*</u> / <u>*Plasmodium malariae*</u> / <u>*Plasmodium ovale*</u> / <u>*Plasmodium vivax*</u> **;** **A** *Plasmodium knowlesi*	**2**

Question	Answer	Marks
6(a)(i)	anaphase **;**	**1**
6(a)(ii)	*any **two** from:* growth **;** **R** growth of cells repair of tissues (by replacement of cells) **;** replacement of, old / dead /damaged / worn out, cells **;** **R** repair of cells asexual reproduction **;** production of genetically identical daughter cells **;**	**2**

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Question	Answer	Marks
6(b)	*any **four** from:* as concentration of Paclitaxel increases, the ratio of cells in anaphase to those in metaphase reduces / there are a greater proportion of cells in metaphase than in anaphase **;** as the concentration of Paclitaxel increases, the percentage of cells in mitosis is increasing **;** use of data to support a described trend **;** *idea that* as the concentration increases, more cells, stop in metaphase / spend more time in metaphase / fewer cells are able to move into anaphase **;** suggested mechanism for halt in metaphase **;** e.g. centromeres do not divide prevents spindle fibres shortening prevents movement of chromatids to opposite poles (because sister chromatids still held together) cells do not pass the (metaphase) checkpoint AVP **;**	**4**

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