Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 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 May/June 2023 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.

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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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Question	Answer	Marks
1(a)(i)	**B** prophase **;** **I** early / mid / late **C** metaphase **;** **A** <u>early</u> anaphase	**2**
1(a)(ii)	*any **three** from:* **A** identical chromatids for sister chromatids *assume points are related to anaphase, unless stated as telophase* sister / identical, chromatids (of each chromosome) separate / AW **;** **A** *idea of spindle fibres pulling apart sister chromatids* *in context of end of metaphase / start of anaphase* movement of / AW, daughter chromosomes / chromosomes / (sister) chromatids, to (opposite) poles (of cell) **;** **R** *if context is a chromosome composed of two chromatids* **R** *if context is movement of sister chromatids to same pole* **I** ends of cell movement (to opposite poles) by spindle fibres, contracting / pulling **;** **I** moved by spindle fibres centromeres, qualified **;** e.g. centromeres divide at start of anaphase (to separate sister chromatids) centromeres leading (during movement so arms of chromosome lagging) *if telophase <u>stated</u>, mark behaviour of chromosomes in telophase to max 2:* (daughter) chromosomes at poles **;** **A** sister chromatids at poles **A** *ref. to* two separate groups of (daughter) chromosomes (chromosomes) become diffuse / become long and thin / decondense / uncoil **;** **A** become chromatin *ref. to* re-forming nucleolus **;**	**3**

Question	Answer	Marks
1(a)(iii)	*any **three** from:* (active during) DNA replication / S phase / synthesis phase **;** **A** during synthesis of DNA / semi-conservative replication joins / AW, Okazaki fragments **; A** description of Okazaki fragments on lagging strand **;** (by catalysing) formation of phosphodiester bonds (between adjacent nucleotides) **;** to complete sugar phosphate backbone / AW **;** e.g. produces continuous, DNA / polynucleotide, strand	**3**
1(b)(i)	at both ends (of interphase chromosomes) **;** **A** on the ends (of, a chromosome	**1**
1(b)(ii)	*any **three** from:* telomeres, maintained / AW, for, longer / greater length of time **;** allows increased, number of cell cycles / DNA replication cycles / AW **;** **A** allows, mitosis / cell division, to occur more times AW **R** speeds up, mitosis / cell division / cell cycle *idea of* prevents loss of genes (at ends of chromosomes, for a longer time) **;** **A** loss of, genetic information / coding DNA **A** less, genes / AW, lost **I** loss of genetic material *ref.* greater ability to replace, damaged / worn out / old, cells **;** *in context of active for a longer time* *idea of* cell metabolism remains optimal / cell does not go through apoptosis / AW **;**	**2**

Question	Answer	Marks
2(a)(i)	*max two if, number of (reported) cases / AW, not stated* *any **three** from:* **1** overall decrease in number of reported cases from 1980 to 2000 / over the time period / AW **;** **2** from, 27 600 / 27 700 / 27 800, to, 16 300 / 16 400, cases **;** **A** manipulated data e.g. decline of, 11 200 / 11 300 / 11 400 / 11 500 cases **3, 4** additional trends **;;** e.g. decrease from 1980 to 1984 increase between 1988 and 1992 **or** (overall) increase between 1984 to 1992 decrease after 1992 (to 2000) little change / slight increase and decrease / AW, between 1984 and 1988 **5** use of comparative values from Fig. 2.1 to support mps, 3 / 4 **;**	**3**
2(a)(ii)	HIV-infected people may develop a weak(ened) immune system **or** people with, HIV/AIDS have a weak(ened) immune system **;** **A** poor immune response **A** *idea of* more susceptible to disease caused by, *Mycobacterium, tuberculosis / bovis* **A** TB is an opportunistic disease (of people with HIV/AIDS) increased risk of latent TB becoming active in (many) people, living with HIV / with HIV/AIDS **;** AW detail of weak immune system **;** e.g. decrease in number of ,T-lymphocytes / T helper cells poor, humoral / B-lymphocyte, response AVP **;** *idea of* more cases of TB owing to more people infected with HIV increases risk of spreading to uninfected people	**2**

Question	Answer	Marks
2(b)	*any **two** from*: **1** prescribe / take, antibiotics, only when (absolutely) necessary **;** **A** examples **e.g.** do not use for viral infections do not use as preventative medicine **2** make sure, correct / effective, antibiotic(s), prescribed / used AW **A** *ref. to*, broad spectrum / narrow spectrum, antibiotics, qualified **or** make sure people take the correct dose **or** complete course / follow instructions for use, of antibiotics **A** *ref. to* DOTS **;** **3** develop new, antibiotics **/** antibacterials **;** **4** use other antibacterials **;** *if mp3 and 4 not gained, allow one mark for* vary antibiotic treatment **or** use a number of different antibiotics at the same time **5** (named) measures to, prevent infection / break transmission cycle (to reduce the need for antibiotic use) **;** e.g**.** vaccines good hygiene in hospitals quarantine people who have multi-drug resistant bacterial infections **6** report, cases / patterns, of antibiotic resistance **;** **7** reduce / control, antibiotics in, agriculture / animals used for food **;** **8** *ref. to* education for, healthcare professionals / public, to reduce impact of antibiotic resistance **;** **9** AVP **;** e.g. *ref. to* monitoring situation to check if antibiotic is effective WHO Global Plan to End TB	**2**
2(c)(i)	(bronchi) may, collapse / lose (structural) support **;**	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(c)(ii)</td><td>one mark each correct <u>column</u> = 3 marks ;;;
if 0 or 1 mark gained, check for correct row to max 2

In the whole table:
• if only ticks are used, assume blanks are crosses
• if only crosses are used, assume blanks are ticks

If there are ticks <u>and</u> crosses and blanks in the whole table, R the columns or rows with the blank(s)

<table>
<tr><th>cell type</th><th>alveolus</th><th>bronchus</th><th>trachea</th></tr>
<tr><td>ciliated epithelial cell</td><td>×</td><td>✓</td><td>✓</td></tr>
<tr><td>goblet cell</td><td>×</td><td>✓</td><td>✓</td></tr>
<tr><td>smooth muscle cell</td><td>×</td><td>✓</td><td>✓</td></tr>
<tr><td>squamous epithelial cell</td><td>✓</td><td>×</td><td>×</td></tr>
</table>
</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)(i)</td><td>X neutrophil ;

Y monocyte ; A lymphocyte I B– / T–</td><td>2</td></tr>
<tr><td>3(a)(ii)</td><td>(magnification) = $\frac{\text{image / line Z, length / width}}{\text{actual width}}$; A (M) = I / A
A magnification triangle

(x) 1500 ; A 1375 (for 11 mm) / 1438 (for 11.5 mm)</td><td>2</td></tr>
</table>

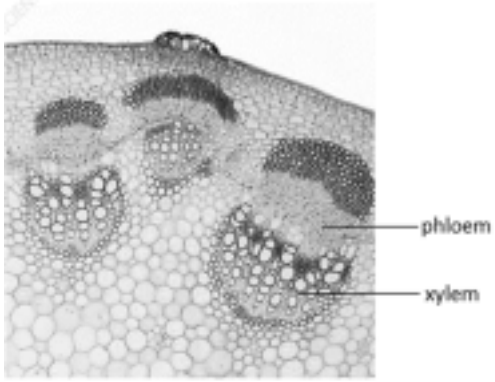
Question	Answer	Marks
3(b)(i)	*any **four** from*: **1** (carbonic anhydrase) catalyses the reaction between CO_2 and H_2O **;** AW **2** to form, carbonic acid / H_2CO_3 **;** **3** H^+ forms (together with HCO_3^- from dissociation of H_2CO_3) **;** **4** H^+ binds to haemoglobin to form haemoglobinic acid **;** **5** displacing / releasing, oxygen from haemoglobin **;** **6** allosteric effect / change in tertiary structure / AW, in (oxy)haemoglobin (causes release of oxygen) **;**	**4**
3(b)(ii)	curve below the original line **;** curve, merging / will merge, with the original line after it begins to plateau **;**	**2**

Question	Answer	Marks
4(a)(i)	<table><tr><th>description</th><th>level of protein structure</th></tr><tr><td>a gliadin protein is a single polypeptide that forms a compact structure</td><td>tertiary</td></tr><tr><td>20% of the amino acids in a glutenin molecule are glycine</td><td>primary</td></tr><tr><td>gliadin and glutenin molecules contain regions of β-pleated sheets</td><td>secondary</td></tr></table> 1 mark per correct row **;;;**	**3**

Question	Answer	Marks
4(a)(ii)	*any **one** relevant*: e.g. RNA / gene, splicing, not needed / does not occur **;** **R** DNA splicing *ref. to* all primary transcript is a coding sequence **;** **A** primary transcript has the same sequence as the mRNA no nucleotides removed, from the primary transcript / after transcription **;** no process of exon joining / AW **;** no non-coding sequences, so introns to not need to be removed **;** no alternative RNA splicing **/** exons not joined in different combinations **;** **A** only one type of mRNA formed / mRNA formed always the same *idea that* only other post transcriptional processing occurs **;** e.g. 5' G (guanine) cap / poly A tail	**1**
4(b)(i)	endocytosis **;** **A** pinocytosis **A** described detail **;** e.g. invagination of membrane / AW use of ATP **A** active process / energy needed formation of (endocytotic / pinocytotic) vesicle *if mp1 gained from description, mp2 must be another detail* *accept other named transport mechanism, with detail*	**2**

Question	Answer	Marks
4(b)(ii)	*any **four** from*: **1** *ref.* presence of, non-self / foreign, antigen **or** gliadin acts as antigen **or** *ref.* to antigen presentation (by macrophages) **;** **2** recognition / activation / AW, of (specific) B- / T-lymphocytes **;** **A** clonal selection **3** clonal expansion of B-lymphocytes (and T-lymphocytes) **;** AW e.g. form a clone of cells (by mitosis) / divide many times by mitosis **4** T-helper cells, secrete / release, cytokine **;** **5** cytokine stimulates, humoral / B-lymphocyte, response **;** *if mp4 and mp5 not gained allow one mark for T-helper cells stimulate B-lymphocyte response* **6** B-lymphocytes (differentiate to) form plasma cells **;** **7** plasma cells, produce / secrete, (anti-gliadin) antibodies **;**	**4**

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Question	Answer	Marks
5(a)	phloem (identified) **;** xylem (identified) **;** e.g. two marks for:  	**2**
5(b)(i)	*any **four** from*: **1** (transport is by) mass flow **;** **2** entry of sucrose into phloem sieve tube, from companion cell / through plasmodesmata **;** **3** sucrose, is dissolved in water / is part of phloem sap / lowers water potential **;** **4** (transport is) down a hydrostatic pressure gradient / from high hydrostatic pressure to low hydrostatic pressure **;** *high hydrostatic pressure* **5** water moves into phloem sieve tube, by osmosis / down water potential gradient / from xylem (at source) **;** **6** increased volume increases hydrostatic pressure **;** *hydrostatic needed once only* *low hydrostatic pressure* **7** (at sink / in other parts of plant) sucrose unloaded, water follows osmotically **;** AW	**4**

Question	Answer	Marks
5(b)(ii)	*any **two** from*: *respiration* **1** less / no, ATP produced from aerobic respiration **;** **A** ETC / oxidative phosphorylation **2** less ATP / energy, for sucrose synthesis (in mesophyll cell) **;** *in context of companion cell* **3** less / no, ATP / energy, for, proton gradient / active transport of protons (out of companion cell) / AW **;** **A** hydrogen ions / H^+ *for protons* **4** less sucrose cotransported (with, protons / hydrogen ions / H^+) into companion cells **;** **5** (less sucrose in companion cells means) decreased diffusion of sucrose (via plasmodesmata) into phloem sieve tubes **;** *if no marks gained, allow 1 mark for less ATP for, active loading / active transport of protons*	**2**
5(c)	Benedict's solution does not react with, non-reducing sugar / sucrose **or** Benedict's solution only reacts with, reducing sugar / glucose **;** AW **A** Benedict's is, a test for reducing sugars / not a test for non-reducing sugars *solution **A** because* sugar present in, cytoplasm / solution **A**, (mainly) reducing sugars / glucose and sugar in, phloem sap / solution **B**, is mainly, sucrose / non-reducing sugar **or** *solution **B** because* phloem sap / solution **B**, contains, a higher concentration of / AW, reducing sugar / glucose, (than, cytoplasm / solution **A**) **;** **A** in cytoplasm glucose stored as, polysaccharide / starch	**2**

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Question	Answer	Marks
6(a)	*any **three** from*: nystose is not branched / glycogen is branched **;** different glycosidic bonds, qualified **;** e.g. nystose has one type of glycosidic bond and glycogen has two types 1-4 and 1-6 (glycosidic) bonds in glycogen (v 1-2 glycosidic bonds in nystose) two types of monomer / AW, in nystose v only glucose in glycogen **;** nystose contains one glucose (residue / monomer) **;** *ref. to* ring shape, glycogen monomers have six-sided rings and nystose has (a) six-sided ring and five-sided rings **;** AVP **;** e.g. fructose in nystose and no fructose in glycogen **I** numbers of C,H and O	**3**

Question	Answer	Marks
6(b)	*any **four** from*: *must attempt both to gain max 4* *rough endoplasmic reticulum* translation (of mRNA) / polypeptide synthesis, at ribosomes **;** **A** protein synthesis polypeptide folding (in lumen) **; A** protein folding packaged in / formation of, transport vesicles / vesicles for transport, to Golgi body **;** *Golgi body* packaging into, Golgi / secretory, vesicles **;** **A** formation of, Golgi / secretory vesicle, containing glycoprotein **A** packaging into vesicles for transport to cell surface membrane *rough endoplasmic reticulum or Golgi body* (modification by) glycosylation (of protein) / described **;** e.g attachment of, sugars / oligosaccharide / polysaccharide / carbohydrate *ref. to* checking for, misfolded / incorrectly synthesised, proteins **;** additional detail of post-translational modification **;** e.g. *suggestion of* forming quaternary structure addition of non-protein groups	**4**

Question	Answer	Marks
6(c)	*any **one** from*: cell signalling **or** receptor(s) / binding site(s) , for , chemicals / hormones / molecules **;** cell recognition **or** (cell surface) antigens **or** cell-cell interactions **;**	**1**

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