Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **October/November 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 October/November 2023 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.

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.

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.

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

A

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

C

(4 responses)

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

E

(4 responses)

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

G

(5 responses)

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

I

(4 responses)

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

B

(4 responses)

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

D

(4 responses)

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

F

(4 responses)

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

H

(4 responses)

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

Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
I	ignore
( )	the word / phrase in brackets is not required, but sets the context
AW	alternative wording (where responses vary more than usual)
underline	actual word given 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 (with relevant number)
ecf	error carried forward
AVP	alternative valid point

Question	Answer	Marks
1(a)	1 irregular shape of cell (surface) membrane / cell loses its biconcave shape **;** **A** cell swells / cell is larger / cell expands / AW **I** cell becomes flaccid / loses turgor / AW *any **two** from:* 2 cell membrane bursts / cell bursts / cell dies / cell lysis / haemolysis **;** **A** short(er) life span 3 daughter cells, fill / AW, the cell **;** 4 cell loses haemoglobin / haemoglobin used up (by pathogen) **;** **A** pathogen uses amino acids from haemoglobin 5 less / no, oxygen transported **;** **A** reduced / decreased, uptake of oxygen 6 release of toxins (by pathogen) **;** **I** change in SA:V ratio / change of water potential	**3**
1(b)	*any **three** from:* 1 pathogen, feeds / grows / synthesises (named) biochemical(s) **;** **A** increase in, volume / mass, of cytoplasm 2 production of (named) organelles **;** 3 DNA, (semi-conservative) replication / synthesis **;** **R** if given in incorrect phase 4 mitosis / mitoses / four named stages of mitosis **;** 5 production of, several / many, nuclei **;** 6 cytokinesis / described e.g. as *ref. to* formation of cleavage furrow **;** **I** division of the cytoplasm 7 daughter cells 'bud off' (from the 'parent') **;** **A** budding	**3**

Question	Answer	Marks
1(c)	*any **three** from:* 1 antibodies bind to, antigens / epitopes **;** **A** attach / combine / join **A** form antibody-antigen complex **I** 'antibodies bind to pathogen' 2 complementary shape to antigens (on surface of malarial pathogen) **;** 3 prevent, pathogen / infective stage, entering, red blood cells / liver cells **;** 4 help / facilitate / AW, destruction by / mark pathogen for, phagocytes **;** **A** stimulates phagocytosis / opsonisation in context / (leads to) lysis of pathogen 5 AVP **;** e.g. phagocytes have receptors for constant region of antibodies e.g. *ref. to* agglutination / described **I** T-cells / production of antibodies by B / plasma cells **I** 'receptors on antibodies' / 'fight' and 'attack'	**3**

Question	Answer	Marks
1(d)	*any **five** from:* 1 access to, whole population / all people at risk **;** *2 idea that* reaching enough of the population to give herd immunity **;** **I** herd immunity unqualified 3 vaccinating children, early enough in their lives / before the time when they are most at risk **;** 4 *ref. to* education about, importance / benefits / advantages / AW, of vaccination **;** 5 countering, anti-vaccination campaigns / misinformation about vaccines **;** **A** *ref. to* 'anti-vaxxers' 6 long duration of protection given by, vaccine / artificial immunity **;** **A** *ref. to* use of a 'live vaccine' 7 little / no, mutation of pathogen (to evade vaccine) **;** **A** little / no, antigenic shift **A** few / no, strains develop **I** 'resistance to vaccine' 8 ability to change vaccine in response to changing strain(s) of pathogen **;** 9 plentiful / good / AW, supply of vaccine **;** 10 sufficient numbers of people trained to deliver vaccine **;** **A** *idea that* administering vaccine is simple process 11 any positive reference to cost **;** e.g. cost of, production / transport / storage / delivery to population **A** vaccine is provided free 12 long shelf life of vaccine **;** 13 stable vaccine(s) **;** e.g. in high temperatures **A** *ref. to* vaccine can be freeze-dried 14 no boosters required **;** **A** easy to find people who need boosters 15 AVP **;** e.g. governments / health authorities / countries, must have enough money to fund programme use of contact tracing to find people, at risk of disease / who should be offered vaccine / AW provide incentives for people to get vaccinated / *idea that* disease is a current threat to population no side effects	**5**

Question	Answer	Marks
2(a)(i)	more, starch / amylose, is produced so iodine (solution), becomes dark(er) / changes from yellow-brown to blue-black **;**	**1**
2(a)(ii)	*prediction* absorbance remains, constant / reaches plateau / at 1.80 **;** **A** 1.79–1.81 **A** increases and flattens *explanation* all, substrate / G-1-P, used up / converted to amylose **;** **A** colorimeter reached its limit for absorbance (at about 2.00) **A** substrate concentration is limiting **or** *prediction* absorbance increases less steeply / increase slows down **;** *explanation* substrate concentration is (becoming) limiting / AW **;** **A** substrate concentration is a limiting factor	**2**
2(a)(iii)	*any **one** from:* colorimeter gives, quantitative / numerical, results / readings **;** *idea that* can use values from the colorimeter to plot graph(s) **;** results are not subjective / no judgements made by eye / AW **;** *idea that* can use calibration curve to determine concentrations (of starch) **;** can take continuous readings / do not have to take samples **;** **I** *'more accurate', 'actual results', 'reliable', 'exact', 'precise', etc.*	**1**

Question	Answer	Marks
2(b)	*any **four** from:* 1 substrate / glucose / G 1-P, binds to active site / forms enzyme-substrate complex / forms ESC **;** 2 <u>end of amylose</u> / glucose (residue) at end of amylose (molecule), binds to active site / forms enzyme-substrate complex / forms ESC **;** 3 active site changes shape when substrate(s) bind **;** *ref. to* induced fit 4 enzyme decreases the activation energy **;** 5 (α-1,4-)<u>glycosidic bond</u> forms **;** **A** glucosidic 6 condensation (reaction) / water formed / AW **;** 7 AVP **;** e.g. any detail of binding to active site – formation of hydrogen bonds e.g. phosphate ion leaves active site e.g. substrate molecules, put under strain / reach transition state / AW *accept a diagram to show bond formation*	**4**

Question	Answer	Marks
3(a)(i)	*if only symbols are used then both have to be clear and correct* alpha / α, globin / (polypeptide) chain <u>and</u> beta / β, globin / (polypeptide) chain **;** **I** alpha and beta polypeptides unqualified	**1**
3(a)(ii)	haem **;** **A** heme / prosthetic group **I** porphyrin ring / iron / Fe / Fe^{2+}	**1**
3(a)(iii)	primary (structure) / sequence of amino acids (in a polypeptide) **;**	**1**

Question	Answer	Marks
3(b)	*any **three** from:* haemoglobin, combines with / binds to / reacts with, carbon dioxide **;** carbon dioxide reacts with (terminal), amine group(s) / $–NH_2$ / –NH, of (each), chain / globin / polypeptide **;** **R** R-group **A** forms a bond with to form carbaminohaemoglobin **;** carbon dioxide is bound / AW, to Hb until in, region of low pCO_2 *or* high pO_2 / pulmonary circulation / lungs / alveoli **;** **A** (carbaminohaemoglobin) dissociates / unbinds, in the lungs / etc.	**3**
3(c)	alveolar capillaries / capillaries around alveoli (in the lungs) **;** **I** 'capillaries in the lungs' / 'pulmonary capillaries'	**1**
3(d)(i)	*any **two** from:* curve shifts to the right (and curve is lower) **;** haemoglobin is less saturated (at every pO_2) / higher pO_2 required to reach same % saturation as low [DPG] **;** **A** data P_{50} is higher / increases **;** **A** described, e.g. pO_2 to give 50% saturated **A** use of data for P_{50} – 3.2 kPa to 4.6 kPa (units used at least once) **I** Bohr effect	**2**
3(d)(ii)	less oxygen is available (for tissues) **;** haemoglobin has a high(er) affinity for oxygen **;**	**2**

Question	Answer	Marks
4(a)(i)	RNA polymerase **;**	**1**
4(a)(ii)	phosphodiester **;**	**1**
4(b)(i)	5 **;**	**1**
4(b)(ii)	*any **two** from:* 1 other strand is not the template strand / only the template strand is transcribed **;** 2 (*if transcribed*) sequence of, nucleotides / bases, in (m)RNA codes for a different sequence of amino acids **;** **A** sequence of codons **A** primary transcript for RNA 3 (*if transcribed*) results in a non-functional polypeptide / AW **;** **A** codes for a polypeptide with different function 4 translation would be a waste of energy / translation will not occur (as no signalling sequence) **;** 5 any suggestion of a possible consequence to structure of collagen **;** 6 (m)RNA is single stranded **;** 7 AVP **;** e.g. RNA polymerase synthesises RNA in the 5' to 3' direction	**2**
4(c)(i)	*ref. to* (mitochondrial) envelope / two membranes / double membrane / inner membrane and outer membrane **;** **R** cell or cell surface membrane inner membrane is folded / crista(e) **;** (70S) ribosomes **;** **R** 80S ribosomes (mitochondrial) matrix **;** **I** DNA	**2**
4(c)(ii)	0.6 (μm) **;** **R** 0.60 (only one significant figure required)	**1**

Question	Answer	Marks
4(d)	*any **three** from:* 1 active transport, uses ATP / moves (ions) against concentration gradient **;** 2 facilitated diffusion, passive / no ATP / no energy / with the gradient / down concentration gradient **;** 3 protein, carrier / pump, changes shape / *ref. to* conformation change / has binding site(s) **;** 4 channel protein / pore protein, for facilitated diffusion (only) **;** **I** carrier protein 5 AVP **;** e.g. *ref. to* ionophore(s) / hydrophilic pore in channel proteins / specificity of carrier *or* channel protein(s) *if mp1 and mp2 are not awarded allow one mark for naming active transport <u>and</u> facilitated diffusion*	**3**

Question	Answer	Marks
5(a)(i)	*assimilates are sucrose, amino acids, (named) monosaccharides or other named disaccharide, (named) hormones, accept (named correct) mineral ions* *root as source* *idea that* root provides (named) assimilate(s) for other parts of the plant **;** **R** if starch is included *root as sink* root is for storage / root is a storage organ **;** **A** root receives (named) assimilates to, store / grow *ref. to* bidirectional transport in phloem **;** direction of movement changes with demands of plant for (named) assimilates **;**	**2**
5(a)(ii)	sucrose <u>and</u> amino acids **;** **A** other named monosaccharides or disaccharide, (named) hormones, (one named correct) mineral ion(s) / organic acid(s) / sugar alcohol(s) / protein(s) / RNA / AW	**1**

Question	Answer	Marks
5(b)	*any **four** from:* 1 (assimilates) diffuse / enter / AW, into (phloem) sieve, tube / element, from companion cells / via <u>plasmodesmata</u> **;** 2 water potential in sieve tubes (in source), decreases / is lower **;** **R** 'lowers water potential gradient' 3 water enters (from surrounding tissues), by osmosis / down water potential gradient **;** 4 hydrostatic pressure builds up **;** **A** hydrostatic pressure difference created / *ref. to* hydrostatic pressure gradient 5 <u>mass flow</u> **;** 6 unloading at, (named) sink, decreases / lowers, hydrostatic pressure **;** 7 description of unloading as assimilates moving out of sieve tubes and water following **;** **I** activity within companion cell	**4**

Question	Answer	Marks
5(c)	*any **three** from:* 1 TMV maximum accumulation is delayed in **V1** and **V2** / AW **;** 2 *data to support mp1:* **V1** does not start to increase, until day 9 / steeply until day 16 **or** **V2** does not start to increase, until day 22 / steeply until day 24 **;** 3 rate at which accumulation increases is slower than the control **;** ora **I** *ref. to* time **A** *ref. to* steepness of accumulation in **V1** and **V2** compared with **C** 4 **V1** and **V2** (and **C**) reach maximum accumulation / AW **;** *5* low quantities of PME do not decrease maximum TMV accumulation **or** normal PME quantity not required to reach maximum TMV accumulation **;** 6 AVP **;** for any other valid comparison, e.g. all are slow to start and then very quick to reach 100% all have the same, pattern / trend **A** correct data: **C** took 8 days, **V1** took 25 days, **V2** took 36 days (from infection) to reach maximum	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>any two from:

(ventricles) pump / AW, blood a greater distance / into the pulmonary and systemic circulations ;
A to the lungs and to the body
R left into lungs and right to body

ventricles have more (cardiac) muscle to, pump / AW, blood, at high(er) pressure / with more force (than atria) ;
R if smooth or striated/skeletal muscle
I ‘pump harder’

(ventricles) pump / AW, blood to overcome a high(er) resistance ;

I answers that only explain why the atria have thinner walls</td><td>2</td></tr>
<tr><td>6(b)</td><td>if SAN and AVN given alone for rows 1 and 2 allow 1 mark

<table>
<tr><th>function</th><th>structure in the heart</th></tr>
<tr><td>initiates the heartbeat</td><td>sinoatrial node ;</td></tr>
<tr><td>delays the wave of depolarisation between the atria and the ventricles</td><td>atrioventricular node
<u>and</u>
non-conducting tissue / AW (between atria and ventricles) ;
I atrioventricular septum</td></tr>
<tr><td>transmits the wave of depolarisation through muscles of the ventricles</td><td>Purkyne / Purkinje, fibres / tissue ;</td></tr>
<tr><td>closes when the left ventricle contracts</td><td>left atrioventricular / bicuspid / mitral, valve ;

R right atrioventricular valve
I AV valves</td></tr>
</table></td><td>4</td></tr>
</table>