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CAMBRIDGE
International Education

Cambridge International AS & A Level

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **February/March 2025**

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 2025 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 descriptions 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	<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.

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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.

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
( )	the word / phrase in brackets is not required, but sets the context

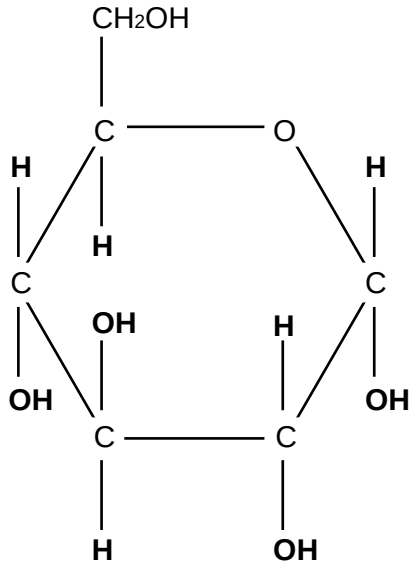
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Question	Answer	Marks
1(a)	light / optical (microscope) **;**	**1**
1(b)	460 / 464 (μm) **;** **A** 450–480	**1**
1(c)	*any **one** from:* increase the surface area **;** reach a larger volume of, soil / soil particles **;** AVP **;** e.g. (root hairs) increase the number of aquaporins in cell surface membrane	**1**
1(d)	*max **two** if answer only refers to either Na^+ or K^+ ions* *any **three** from:* 1 facilitated diffusion because, higher concentration Na^+ in soil solution / lower concentration Na^+ in root hair cells **;** 2 active, transport / uptake, because, higher concentration K^+ in root hair cells / lower concentration K^+ in soil solution **;** 3 ions / AW, cannot, diffuse / pass through the, cell (surface) membrane / phospholipid bilayer **;** 4 (so) facilitated diffusion uses, channel / carrier proteins **or** active transport uses carrier proteins **;**	**3**
1(e)	(movement of water) from cell **A** to cell **B** by osmosis **;** from higher water potential to lower water potential / from less negative ψ to more negative ψ / down the water potential gradient **;**	**2**
1(f)(i)	*any **four** from:* 1 (carbon dioxide reacts with water resulting in) carbonic acid produced **;** **accept** from equation 2 carbonic acid dissociates to form, hydrogencarbonate (ions) / HCO_3^-, and, protons / H^+ **;** **accept** from equation **accept** bicarbonate for hydrogencarbonate 3 pH of soil (solution) lowered / soil (solution) becomes more acidic **;** **accept** correct paired data quotes as alternative to lower pH 4 at lower pH clay particles lose Fe^{2+} / H^+ displaces Fe^{2+} from clay particles **;** 5 hydrogencarbonate ions attract (bound) Fe^{2+} into soil solution **;** 6 AVP **;** e.g. no carbonic anhydrase in soil solution, so reaction slow	**4**

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Question	Answer	Marks
1(f)(ii)	*any **three** from:* 1 (Fe^{2+}) must cross the cell surface membrane at endodermis / Fe^{2+} moves into, cytoplasm / symplastic route **;** 2 due to Casparian strip / impermeability of suberin / AW **;** 3 idea that the cell regulates the, quantity / activity, of transport proteins **;** 4 metabolised / changed, to insoluble iron compounds (and stored in root) **;** 5 transported into / stored in, vacuole of endodermal cell **;**	**3**

Question	Answer	Marks
2(a)	 H and OH correct on C1 **;** all other additions complete and correct **;**	**2**
2(b)(i)	**C** – <u>peptide</u> (bond) **;** **D** – <u>glycosidic</u> (bond) **;**	**2**
2(b)(ii)	act as receptors / bind to ligands, qualified **;**	**1**

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Question	Answer	Marks
2(c)	*any **four** from:* *less organised secondary structure (max **three**):* 1 high proportion of proline so less hydrogen bonding **;** 2 so less, alpha helix / beta-pleated sheet, formation **;** 3 **l**ess opportunity to form hydrogen bonds between –NH of one amino acid and –C=O of another amino acid (close by) **;** 4 AVP **;** e.g. greater proportion would have ~~a~~ random, coiling / structure **;** *relatively little tertiary structure (max **three**):* 5 fewer amino acids will be forming ionic bonds between R-groups **;** 6 little cysteine so, less / no, disulfide bonding (for tertiary structure) **;** 7 (relatively little serine) so less hydrogen, bonding (in tertiary structure) **;** 8 AVP **;** e.g. high proportion of hydrophobic amino acids (proline and leucine) so tertiary structure will be more dependent on hydrophobic interactions	**4**

Question	Answer	Marks
3(a)(i)	semi-lunar valve **;** **accept** aortic valve / pulmonary valve	**1**
3(a)(ii)	1 from the atria to the ventricles **;** 2 into the (left and right) atria from the pulmonary vein and vena cava **;** **A** venae cavae for vena cava **A** superior vena cava and inferior vena cava	**2**
3(b)	*stage of cardiac cycle:* ventricular systole **;** *reason:* bicuspid / mitral, valve <u>and</u> tricuspid valve closed **or** atrioventricular valves closed **or** semi-lunar valves / aortic <u>and</u> pulmonary valves, open **;**	**2**

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Question	Answer	Marks
3(c)	*any **three** from:* 1 impulses reach the atrioventricular node **;** 2 short delay / after 0.1 s **;** 3 (AVN) sends impulses through, Purkyne fibres / Bundles of His **;** **A** Purkinje for Purkyne 4 impulses (travel down through the septum and) reach the, base / apex, of the ventricles / heart **;** 5 atria complete contraction / atria and ventricles do not contract at the same time / ventricles fill with blood / atria empty **;** 6 impulses travel upwards / AW, causing ventricles to contract from base upwards **;** 7 ref. to (both) ventricles contract at same time **;**	**3**

Question	Answer	Marks
4(a)(i)	(caused by) <u>pathogen</u> **and,** transmissable / AW **;**	**1**
4(a)(ii)	*any **three** from:* 1 ref. to presence of, (B / T) memory cells from primary immune response **;** 2 increased chance of memory cells encountering antigen **;** 3 more lymphocytes, with receptors complementary / specific, to antigens **;** 4 more plasma cells created **;** 5 increased / faster, production of antibodies **;**	**3**
4(b)(i)	passive **and** artificial **;**	**1**
4(b)(ii)	*any **two** from:* temporary / short term **;** immediate effect **;** involves injection of, antibodies immunoglobulin **;** does not, stimulate the immune system / initiate a primary immune response **;** AVP **;** e.g. no memory cells produced no new antibodies made	**2**
4(c)(i)	*Mycobacterium tuberculosis* / *Mycobacterium bovis* **;**	**1**

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Question	Answer	Marks
4(c)(ii)	*any **four** from:* *treatment (max 3):* 1 combining rifampicin treatment with drugs, that keep rifampicin inside the bacteria / indigestion drugs **;** 2 rifampicin will kill bacteria (more, effectively / quickly) **;** 3 reduce length of time needed for successful treatment of TB (from 6 months) **;** 4 shorter treatment increases likelihood that treatment will be completed **;** 5 idea that use of, widespread / common, indigestion drugs should reduce costs of (usually) long-term TB treatment **;** 6 less need for DOTS for some people **;** *reduce chance of resistance:* 7 (if the length of treatment is shorter there is) less time for a mutation to occur in bacterial genome resulting in resistance to rifampicin **;** 8 AVP **;** e.g. dea that the indigestion drugs may be inhibiting membrane pumps in the cell surface membranes of TB bacteria	**4**

Question	Answer	Marks
5(a)	histones **;** chloroplasts **;** bacteria / cyanobacteria / Archaea **;** **accept** named prokaryote cytoplasm **;**	**4**
5(b)(i)	non-transcribed strand **;**	**1**
5(b)(ii)	primary transcript **;**	**1**
5(b)(iii)	<table><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr><tr><td>A</td><td>U</td><td>G</td><td>C</td><td>A</td><td>U</td></tr></table> **;**	**1**

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Question	Answer	Marks
5(c)	*any **three** from* 1 ref. to non-competitive inhibition **;** 2 binding of alpha-amanitin changes shape of active site **;** 3 active site, no longer / less, complementary to, substrate / DNA **or** fewer enzyme–substrate complexes formed **;** 4 prevents RNA polymerase from, binding to DNA / unwinding DNA / rewinding DNA **;** 5 blocks movement of the polypeptides of the enzyme / prevents the enzyme changing shape / hinders induced fit **;** 6 RNA polymerase movement along DNA, prevented / slowed down **;** **accept** prevents addition of nucleotides to the chain	**3**

Question	Answer	Marks
6(a)(i)	**B** | E | F | D | A | C **;**	**1**
6(a)(ii)	*any **two** from:* nuclear envelope re-forms (around each group of chromosomes) **;** nucleolus / nucleoli, re-form(s) **;** (daughter) chromosomes uncoiling / AW **;** spindle breaking down / AW **;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(b)</td><td>
<table>
<tr><th>term</th><th>description</th></tr>
<tr><td>telomere ;</td><td>region of DNA with repeated nucleotide sequences located at the ends of chromosomes</td></tr>
<tr><td>(pair of) centriole(s) ;
A centrosome</td><td>organises microtubules to form the spindle in animal cells</td></tr>
<tr><td>centromere ;</td><td>point of attachment between two sister chromatids</td></tr>
</table>
</td><td>3</td></tr>
</table>

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