CAMBRIDGE
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Cambridge International AS & A Level

BIOLOGY **9700/21**

Paper 2 AS Level Structured Questions **October/November 2024**

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **16** printed pages.

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 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.

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.

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

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th rowspan="2">organelle</th><th colspan="3">cell type</th></tr>
<tr><th>animal cells</th><th>plant cells</th><th>prokaryotic cells</th></tr>
<tr><td>nucleus</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>large permanent vacuole</td><td>×</td><td>✓</td><td>× ;</td></tr>
<tr><td>rough endoplasmic reticulum</td><td>✓</td><td>✓</td><td>× ;</td></tr>
<tr><td>Golgi body</td><td>✓</td><td>✓</td><td>× ;</td></tr>
<tr><td>centrioles</td><td>✓</td><td>×</td><td>× ;</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>1(b)(i)</td><td>microvilli ;</td><td>1</td></tr>
<tr><td>1(b)(ii)</td><td>site of aerobic respiration, so
produces / provides, ATP ;
A provides energy
R produces energy

use of ATP in context of absorption of digested food
for, active transport I (idea of) absorption against a concentration gradient
or
endocytosis / pinocytosis; A bulk transport into cell(s) ;</td><td>2</td></tr>
</table>

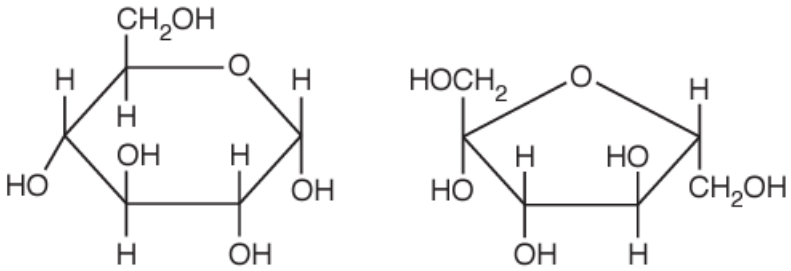
Question	Answer	Marks
2(a)	arteriole/s **;** venule/s **;**	**2**
2(b)	*any **three** from:* (because) water is, polar / a polar molecule / polar / dipolar **;** **A** delta positive hydrogen atom / $H^{\delta+}$, **and,** delta negative oxygen atom / $O^{\delta-}$ *ref. to* attraction between, (negatively charged) chloride ions / Cl^-, and $H^{\delta+}$ **;** *ref. to* attraction between, (positively charged) sodium ions / Na^+ and $O^{\delta-}$ **;** *if both ideas (mp2 and mp3) stated, then this is also mp1* water molecules collect around sodium chloride (and separate ions) **;** AVP **;** e.g. ionic bond broken (between sodium and chloride atom) *ref. to* hydration shell(s) *idea that* ions are separated (and spread through the water) *If no marks gained allow one mark for idea of attraction between water and, ions / NaCl*	**3**
2(c)(i)	line drawn to the left **;** sigmoid shape of line and starting at 0, 0 **;**	**2**

Question	Answer	Marks
2(c)(ii)	*any **three** from:* oxygen can be released (from haemoglobin to supply respiring tissues) **;** increase in H^+ ions so more, hydrogen ions bind to haemoglobin / haemoglobinic acid forms **;** haemoglobin affinity for oxygen reduces (when the pH decreases) **;** aerobic respiration in muscle cells can continue for longer **;** AVP **;** e.g. *ref. to* Bohr shift **/** curve shifts to right providing ATP for muscle contraction	**3**
2(d)	sinoatrial node **; I** SAN	**1**

Question	Answer	Marks
3(a)	**J** cartilage **;** **K** smooth muscle **;** *difference* **I** *ref. to* other tissues *plus **one** from:* cartilage in bronchus but not the bronchioles **;** suggestion for smooth muscle tissue (*ref. to* **K**) **;** e.g. proportionally more smooth muscle in the wall of the bronchiole	**3**
3(b)(i)	*Mycobacterium tuberculosis* / *Mycobacterium bovis* **;**	**1**
3(b)(ii)	antigen binding site(s) **; A** variable region	**1**
3(b)(iii)	*any **two** from:* **A** antigen *for TB protein* **A** TB pathogen for pathogen causing TB (immobilised) monoclonal antibody has a binding site which is a complementary shape to the protein secreted by the TB pathogen **;** monoclonal antibody on the test line will only bind with protein secreted by the by the TB pathogen **;** *idea that* monoclonal antibodies with tiny gold particle are only held in place if protein secreted by the TB pathogen is present **;** AVP **;** e.g. *suggestion that* TB protein is specific to the TB pathogen	**2**

Question	Answer	Marks
3(b)(iv)	*any **two** from:* different shaped, variable region / antigen binding site **;** *ref. to* different primary structure **;** *ref. to* a different tertiary structure **;** *ref. to* different (named) bonds holding the tertiary structure **;**	**2**
3(c)	*any **three** from:* provides (long-term) immunity **;** *context of pathogen entering the body* *ref to* secondary / fast / strong, immune response **;** because of presence of increased numbers of specific T-lymphocytes **;** memory T-lymphocytes, recognise / bind to / activated by, the foreign antigen **;** T- helper cells secrete. cytokine / interleukins **; I** cell-signalling molecules example of consequence of increased cytokine release **;** e.g. increased phagocytosis / angry macrophages increased, B-lymphocyte / humoral, response enhance T-killer cell response	**3**
3(d)(i)	endocytosis **; A** phagocytosis	**1**

Question	Answer	Marks
3(d)(ii)	*any **three** from:* some T-lymphocytes have receptors with a complementary shape to the antigen on the tumour cell **;** antigens on the surface of the tumour cell bind to receptor / *ref. to* clonal selection **;** T-lymphocytes, divide by mitosis / *ref. to* clonal expansion **;** T-killer cells are produced that destroy the tumour cell **;** method used by T-killer cell to destroy tumour cell **;** e.g. perforin, hydrogen peroxide, granzymes **A** toxins *ref. to* B lymphocytes and antibodies **;** AVP **;** e.g. further detail of method used by T-killer cell *ref. to* phagocytosis of cancer cells	**3**

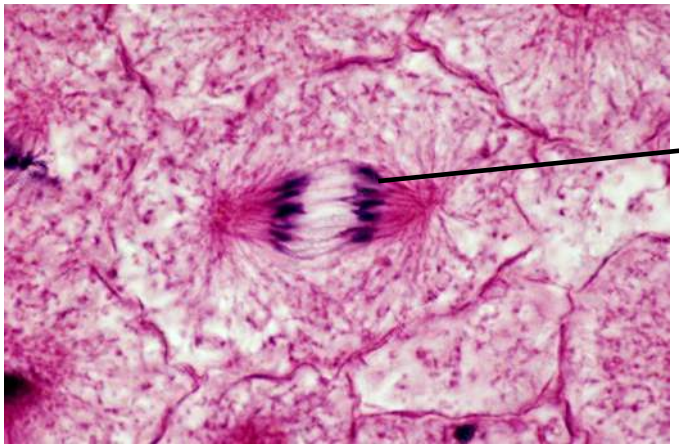
Question	Answer	Marks
4(a)(i)	glycosidic **;**	**1**
4(a)(ii)	 *any **three** from:* label one monomer correctly **;** α-glucose with a hydroxyl group on C1 **;** fructose drawn with a hydroxyl group on C2 **;** water used in the reaction **;**	**3**
4(b)(i)	sieve plate **;**	**1**

Question	Answer	Marks
4(b)(ii)	*any **four** from:* **1** carbohydrate is transported in (phloem) sieve tubes **;** **A** sucrose transported **A** sieve tube elements **2** as the percentage of outer stem tissue removed increases, the quantity of phloem (sieve tubes) remaining decreases **;** **3** less, mass flow / translocation **;** **4** 0 mg at 100% removal because all phloem removed / AW **;** **5** carbohydrate is not transported in xylem tissue, as there is no transport when xylem tissue is left intact **;** **6** *ref. to* movement to lower part of stem from source to sink **;** **7** AVP **;** e.g. *suggestion that* most of the (active) phloem is in the inner part of the outer stem *idea that* phloem sieve tubes are arranged in layers	**4**

Question	Answer	Marks
4(c)	*any **four** from:* *max 3* **1** example of structural change to sucrase **;** e.g. translation stops prematurely / truncated polypeptide / AW change in the primary structure / different amino acid(s) polypeptide does not, fold into / form, (correct) tertiary structure **2** suggestion of why sucrase is non-functional **;** e.g. active site, not complementary / changed shape binding site changed shape, sucrose does not bind to active site catalytic site changed shape, glycosidic bond cannot be broken **3** polypeptide not produced as mRNA does not attach to ribosome **;** **4** polypeptide recognised as abnormal and degraded **;** *max 3* **5** deletion mutation is loss of one or more nucleotides (in the gene coding for sucrase) **;** **6** (causes a) change in the sequence of, nucleotides / bases / base pairs, (in the, gene coding for sucrase / DNA molecule) **;** **7** (causes a) change in the sequence of, nucleotides / bases, in, mRNA / an mRNA molecule **;** **8** consequence to codons **;** *(if not a deletion of, three / multiples of three)* all the codons after the deletion mutation are altered causes a frameshift *(deletion, of three / multiples of three)* one or more codons absent, then same sequence **9** mutation may, form a premature stop codon / introduce a stop codon **;**	**4**

Question	Answer	Marks
5(a)(i)	*correct answer as a whole number* 34(%) **;**	**1**
5(a)(ii)	*allow enzyme for trypsin* *allow substrate for casein* *any **five** from:* **1** at lower concentrations there are not enough, active sites / enzymes **;** **2** idea of substrate molecules cannot enter active site until product released **;** **3** as concentration increases, increased number of active sites **;** **4** idea that as concentration increases there are more successful collisions between enzyme and, substrate / casein **;** **5** (so) allows increase in (number of) enzyme-substrate complexes (formed per unit time) **;** **6** increased rate of casein breakdown as enzyme concentration increases **;** **7** *ref. to* casein reaction e.g. milk becomes transparent as solution contains amino acids **;** **8** AVP **;** e.g. depends on how many active sites available at any one time *ref. to* enzyme-substrate complex formation per unit time at high concentration substrate concentration is becoming the limiting factor when clear, total hydrolysis of casein has occurred	**5**

Question	Answer	Marks
5(b)(i)	*any **one** from:* immobilising the enzyme may have altered the, tertiary structure of the enzyme / shape of the active site **;** *suggestion that* material may not be inert and may have an inhibitory effect at lower temperatures **;** immobilising may have covered, part of the active site / active site of some enzymes **;** *idea that* trypsin free in solution has increased chance of collision with substrate **;** immobilising changes the optimum temperature of the enzyme **;**	**1**
5(b)(ii)	*any **two** from:* immobilisation, protects / stabilises / AW, the, enzyme / trypsin **;** from (thermal) denaturation **; ora** enzyme free in solution denatured maintains shape of active site **;** immobilisation may result in lower, kinetic energy / vibration, of the enzyme molecules compared to free (so protects from denaturation) **; ora** prevents the breaking of bonds holding the tertiary structure (of immobilised enzyme molecule) **; ora** *ref. to*, hydrogen / ionic bonds **;**	**2**

Question	Answer	Marks
6(a)	line pointing to any chromatid **;**  	**1**
6(b)	anaphase **;**	**1**
6(c)	*any **two** from:* (fully formed) spindle seen / spindle fibres, are visible **;** *idea that* chromatids are attached to, the spindle fibres / (spindle) microtubules **;** *idea that* chromosomes would have orientated at the equator (ready for anaphase) **;** sister chromatids have separated (Fig. 6.1) because, spindle fibres have contracted / microtubules have disassembled / AW **;** in anaphase so has, completed /AW, prophase / metaphase **;**	**2**