CAMBRIDGE
International Education

# Cambridge International AS & A Level

**BIOLOGY** **9700/21**

Paper 2 AS Level Structured Questions **May/June 2026**

MARK SCHEME

Maximum Mark: 60

**Published**

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.



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**General marking principles**

All examiners must apply these marking principles when marking candidate responses.

| | |
|---|---|
| 1 | Examiners must award marks for each response in line with:<br><br>• the specific **content** defined in the mark scheme<br>• the specific **skills** defined in the mark scheme or in the level descriptions<br>• the **standard of response** required as exemplified by the standardisation scripts. |
| 2 | Examiners must award **whole marks** (not half marks, or other fractions). |
| 3 | Examiners must award marks **positively**. This means that:<br><br>• marks are not deducted for errors or omissions<br>• marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate<br>• the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous. |
| 4 | Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly. |
| 5 | Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen. |
| 6 | Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions 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<br><br>For questions that require ***n*** responses (e.g. State **two** reasons …):<br><br>• The response should be read as continuous prose, even when numbered answer spaces are provided.<br>• Any response marked *ignore* in the mark scheme should not count towards ***n***.<br>• Incorrect responses should not be awarded credit but will still count towards ***n***.<br>• 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.<br>• 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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**Annotations guidance for centres**

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

**Annotations**

| Annotation | Meaning |
|---|---|
|  | correct point or mark awarded |
|  | correct awarding one mark from marking point or marking group 1.<br>similar numbered ticks are used for marking point or marking groups 2, 3, 4 etc. |
|  | incorrect point or mark not awarded |
|  | working towards marking point |
|  | information missing or insufficient for credit |
|  | used to highlight part of an extended response |
|  | used to highlight part of an extended response |
|  | allow or accept |
|  | benefit of the doubt given |

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| Annotation | Meaning |
|---|---|
| CON | contradiction in response, mark not awarded |
| ECF | error carried forward applied |
| I | incorrect or insufficient point ignored while marking the rest of the response |
| IRRL | irrelevant material that does not answer the question |
| O | or reverse argument |
| PAG | point already given |
| R | incorrect point or mark not awarded |
| SEEN | point has been noted, but no credit has been given<br>or<br>blank page seen |

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**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 |
| **bod** | allow benefit of doubt |

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| Question | Answer | Marks |
|---|---|---|
| 1(a)(i) | measure, length / **A** / AW, (on image) **and** divide by, magnification / 5000 **;**<br>**A** size for length to convert from mm to μm multiply by 1000 **;**<br>**A** cm to μm, multiply by 10 000<br>**A** if shown as part of the actual calculation<br><br>*if no marks gained allow one mark for correct formula*<br>actual length = $\frac{\text{length of, **A** / organelle / mitochondrion / image}}{\text{magnification / 5000}}$<br>**bod** A = I / M ***or*** I = A × M ***or*** M = I / A ***or*** magnification triangle | **2** |
| 1(a)(ii) | nucleus / nuclear envelope<br>nucleolus<br>cell surface membrane<br>Golgi body<br>**A** Golgi, apparatus / complex<br>**bod** lysosome(s)<br>**I** cytoplasm / mitochondria / vesicles<br>} any **two** for one mark **;** | **1** |
| 1(a)(iii) | *any **two** from:*<br>**A ora** for TEM<br><br>**1** light microscope has, low(er) / poor(er), resolution (than EM) **;**<br>**2** *idea of* light microscope has a lower ability to distinguish between points **;**<br>**A** definition of resolution<br>**3** structures closer together than, 0.2 μm / 200 nm, are not visible as separate<br>**or**<br>a structure smaller than, 0.2 μm / 200 nm, is not visible<br>**A** range / within range, of, 0.1 μm – 0.3 μm / 100 – 300 nm<br>**or**<br>some structures are smaller than the resolution of the light microscope **;**<br>**A** some structures are smaller than half the wavelength of light | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 1(b) | *any **three** from:*<br>**1** nucleus is site of, genes coding for enzymes / transcription / production of messenger RNA **;**<br>**A** mRNA<br>**2** (80S) ribosomes / <u>rough endoplasmic reticulum</u>, for, protein / enzyme, synthesis / production **;**<br>**I** RER<br>**A** for, translation / assembling of amino acids / polypeptide formation<br>**R** if 70S ribosomes<br>**3** rough endoplasmic reticulum detail **; ecf** on abbreviation (RER) in mp2<br>e.g.<br>for post-translational modification / modification of protein(s) / protein folding / AW<br>for production of transport vesicles *context is to Golgi body*<br>**4** Golgi body, for modification of protein / packaging protein into (Golgi / secretory) vesicles **;**<br>**A** vacuoles *for vesicles*<br>**A** glycosylation / processing / described, for modification<br>**I** any qualification of protein, e.g. defective<br>**5** Golgi / secretory, vesicles for, transport to cell (surface) membrane / exocytosis / fusion with cell (surface) membrane **;**<br>**6** mitochondria provide, energy / ATP (for protein synthesis / movement of vesicles / exocytosis / amino acid activation) **;**<br>**7** AVP **;** e.g. nucleolus for production of, rRNA / ribosomal subunits / ribosomes | **3** |

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| Question | Answer | Marks |
|---|---|---|
| 2(a)(i) | caused by pathogen(s) **;**<br><br>transmissible **;**<br>**I** contagious<br>**A** communicable<br>**bod** transfer from infected person to uninfected person | **2** |
| 2(a)(ii) | *any **two** from:*<br>**1** HIV / virus, mutates frequently / AW **;**<br>**A** high rate of mutation<br>**2** *idea that* different, antigens / proteins on surface (of the virus) **;**<br>**A** antigenic variation<br>**3** different strains of HIV exist **;**<br>**I** species<br>**4** HIV enters cells so beyond reach of antibodies / ref. to antigenic concealment / incorporates into host DNA **;**<br>**5** AVP **;** e.g. antigens change too quickly for vaccine development to keep up<br>**v**accines cannot contain all antigens<br>need a new vaccine for each, strain / type / variant<br>*idea that* if attenuated virus is used there is a risk of vaccine-derived infections<br>*idea that* any immunity gained to vaccine will not be of any use if antigens keep changing | **2** |
| 2(b)(i) | 85 (%) **;** | **1** |
| 2(b)(ii) | *row 1*<br>testing blood donors / only accepting blood donations from HIV-negative people / screening blood donations / heat-treating blood donations / *ref. to* saving blood before blood transfusion (autologous blood transfusion) **;**<br>**I** use sterile needles<br><br>*row 2, **one** from assume mothers are HIV-positive*<br>(test mothers for HIV and if positive) start on, anti-retroviral treatment / ART **;**<br>give the baby ART **;**<br>advise mothers to avoid breast-feeding **;**<br>(feed baby) with formula milk only / AW **;**<br>**A** *ref. to* wet nurse / uninfected woman<br>deliver babies by, caesarean section / C-section **;** | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 3(a)(i) | *row numbers refer to Figure 3.1*<br><br>*any **three** from:*<br>**1** both DNA and RNA have purines, which are adenine and guanine (row 1) **;**<br>**2** both DNA and RNA have the pyrimidine cytosine but DNA has thymine and RNA has uracil (row 2) **;**<br>**3** in DNA, purine pairs with pyrimidine / adenine pairs with thymine and guanine pairs with cytosine B; **A** A-T and G-C<br>**A** single ring base-paired with double ring base *instead of purine - pyrimidine*<br>**4** RNA is formed by base pairing during transcription from (template strand of) DNA so can only have 4 bases **;**<br><br>*if no marks gained allow **one** mark for naming all five bases / letters in the correct context(s)* | **3** |
| 3(a)(ii) | *any **two** from:*<br>base joins with a pentose sugar, which joins with a phosphate (group) **;**<br>**A** (base) joins with pentose sugar and phosphate (group)<br>**A** deoxyribose (for DNA) / ribose (for RNA)<br>to form a nucleotide **;**<br><br>AVP **;** e.g. correct *ref. to* nucleoside (i.e. sugar and base)<br>two further phosphate groups added / become activated nucleotide<br>join to adjacent nucleotide by phosphodiester bond | **2** |
| 3(a)(iii) | *any **four** from:*<br>**1** each amino acid is coded by a, triplet of bases / triplet of nucleotides / group of three bases / group of three nucleotides / a codon **;**<br>**2** (reading frame is) non-overlapping **;**<br>**3** no gaps / *idea of* continuous sequence **;**<br>**4** *ref. to* start codon **and** stop codon **;**<br>**5** sequence of, codons / triplets (of bases), determines the <u>primary structure of polypeptide</u> **;**<br>**6** AVP **;** e.g. *ref. to* degenerate / redundant, code **or** more than one codon for some amino acids<br>**7** AVP **;** start codon, is AUG / codes for met<br>stop codon / UGA / UAG / UAA, do not coding for an(y) amino acid / for chain termination | **4** |

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)(i)</td><td>if a row contains more than one process both or all must come from this list below<br><br>
<table>
<tr><th>stage</th><th>process involving DNA in the nucleus</th></tr>
<tr><td>1</td><td>transcription / RNA synthesis / RNA production /<br>error checking / unwinding / uncoiling</td></tr>
<tr><td>2</td><td>(semi-conservative) replication / sister chromatid formation / forming<br>complex with histones / synthesis of histones</td></tr>
<tr><td>3</td><td>error checking</td></tr>
<tr><td>4</td><td>condensation / coiling / supercoiling / described in terms of<br>histones / shortens / thickens / AW<br>I becomes visible</td></tr>
</table></td><td>3</td></tr>
<tr><td>3(b)(ii)</td><td>any two from:<br>I any points to do with cytokinesis in plant cells<br>cleavage furrow forms ;<br>constriction of cytoplasm / cell (surface) membrane ‘pinches in’ ;<br>membrane fusion occurs ;<br>organelles shared between daughter cells ;<br>AVP ; e.g. ring of microtubules formed underneath cell (surface) membrane (pulls in membrane)</td><td>2</td></tr>
</table>

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| Question | Answer | Marks |
|---|---|---|
| 3(b)(iii) | *award mp1 for either enzyme*<br><br>**1** forms phosphodiester bonds<br>**or**<br>(function) during, DNA replication / S phase (of interphase) **;**<br><br>*DNA polymerase*<br>**2** forms bonds between / joins, activated / free, nucleotides, and, elongating / AW, strand **or** in a 5´ to 3´ direction **;**<br>**A** lengthening / growing / new / synthesising *for elongating*<br>**I** *ref. to* template strand<br>**3** error checking / proof reading **;**<br><br>*ligase*<br>**4** forms bonds between / joins, Okazaki fragments / DNA sections on the lagging strand **;** | **3** |

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| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | *reject if more than one component given*<br>*ignore names of regions*<br><br>**P** – elastic tissue / elastic lamina / elastic fibres / elastin **;** **bod** endothelium / endothelial cells<br>**Q** – <u>smooth muscle</u> (tissue / cells) **;**<br>**R** – collagen fibres / collagen **;** | **3** |
| 4(a)(ii) | *any **three** from:*<br>**I** thick wall to withstand pressure<br>**I** names of tunica layers<br><br>**1** endothelium, for protection / folded to allow expansion / allows smooth blood flow / reduces friction / reduces resistance to flow **;**<br>**2** elastic fibres / AW, (stretch to) allow artery to, expand / increase (lumen) diameter **;**<br>**3** elastic fibres / AW, recoil to, help (onward) blood flow / help maintain pressure / prevent overstretching / prevent bursting **;**<br>**4** smooth muscle contracts to, maintain pressure (for onward blood flow) / reduce blood flow to capillaries / for vasoconstriction<br>**I** constricts *for contracts*<br>**5** smooth muscle relaxes, to increase blood flow to capillaries / for vasodilation **;**<br><br>*if mp4 and mp5 are not gained, allow **one** mark for* smooth muscle for vasoconstriction **and** vasodilation<br>**or** smooth muscle contracts and relaxes to, change diameter of lumen / control blood flow<br><br>**6** collagen (provides strength to) provide support / maintain structure / withstand pressure<br>**or**<br>collagen prevents, overstretching / bursting / AW **;** | **3** |
| 4(a)(iii) | *any **two** from:* **ora** for muscular artery<br>**1** (lumen / diameter, of) aorta is, wider / larger / bigger / greater **;**<br>**2** thicker, wall / tunica media / region **Q** (**Figure 4.1**) **;** **bod** middle layer<br>**3** (wall has) greater proportion of elastic fibres to (smooth) muscle (in tunica media) **;**<br>**4** (wall has) more collagen fibres in, tunica externa **;**<br>**A** tunica adventitia **bod** outer layer<br>**5** lumen is smaller relative to thickness of wall / smaller ratio of lumen : wall thickness / larger ratio of wall thickness : lumen | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 4(b) | **I** *any dots in cytoplasm or nucleus*<br>**I** *any differences in size*<br><br>*neutrophil*<br>nucleus divided into at least two lobes **;**<br><br>*lymphocyte*<br>circular nucleus fills almost all of the cell **;**<br>**A** at least 75%<br>**R** kidney-shaped nucleus | **2** |
| 4(c) | *any **one** from:*<br>*if more than one answer all the answers must be correct*<br><br>*bronchus has*<br>ciliated epithelium / cilia **;**<br>goblet cells / mucous glands **;**<br>cartilage **;** | **1** |

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| Question | Answer | Marks |
|---|---|---|
| 5(a) | (α–)glucose **and** fructose **;**<br>**R** β-glucose<br>**I** α– or β– in front of fructose | **1** |
| 5(b) | **1** sucrose, diffuses / moves down the concentration gradient, from mesophyll cell, through plasmodesmata / in the symplast pathway, to the phloem parenchyma cell **;**<br>**or**<br>sucrose, diffuses / moves down the concentration gradient, from phloem parenchyma cell, through plasmodesmata / in the symplast pathway, to the companion cell **;**<br><br>*and any **four** from mp2 to mp6:*<br>*phloem parenchyma cell to companion cell*<br>**2** sucrose moves out of phloem parenchyma cell to, cell wall / apoplast **A** diffuses out (because of part (c))<br>**or**<br>diffusion / movement, through, apoplast / cell wall, of (phloem) parenchyma cell to (apoplast / cell wall of) companion cell **;**<br>**3** *ref. to* proton pump / ATP required, for movement of protons out of companion cell (into companion cell wall) **;**<br>**A** active transport of protons out of companion cell<br>**4** sucrose cotransported with, hydrogen ions / protons / $H^+$, into companion cell **;**<br>**A** sucrose and, $H^+$ / protons, enter companion cell through cotransporter (protein)<br>**5** movement of sucrose against the concentration gradient (into companion cell) **;**<br>**6** movement of, $H^+$ / protons, by facilitated diffusion **;**<br>**7** sucrose, diffuses / moves down the concentration gradient, (from companion cell) into phloem sieve tube element through plasmodesmata **;**<br>**8** AVP **;** e.g. movement out of sucrose from (phloem) parenchyma cell to apoplast by facilitated diffusion | **5** |

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| Question | Answer | Marks |
|---|---|---|
| 5(c)(i) | *any **three** from:*<br>**1** (SWEET is a) transmembrane / integral / intrinsic / carrier (protein) **;** **bod** channel protein<br>**A** described<br>**2** protein extends, above and below / beyond, phospholipid bilayer / membrane **;**<br>**3** single polypeptide **;**<br>**4** seven alpha helices (within cell (surface) membrane) **;**<br>**A** protein is composed of alpha helices<br>**A** (secondary) structure of protein is alpha helix<br>**R** protein has alpha helices and beta pleated sheets<br>**5** helices are, parallel / AW **;**<br>**ecf** from MP3 – polypeptides are, parallel / AW<br>**6** (helices form a) hydrophilic, pathway / pore / channel / AW (for sucrose) **;**<br>**7** (SWEET is a) globular protein **;**<br>**8** AVP **;** e.g. random coils | **3** |
| 5(c)(ii) | *any **two** from:*<br>sucrose is, a polar molecule / (water) soluble / hydrophilic / is not lipid soluble **;**<br>will not pass through, hydrophobic core of membrane / fatty acid tails of phospholipids / AW **;**<br>SWEET protein allows a hydrophilic route (through membrane) **;**<br>SWEET protein allows facilitated diffusion **;** | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 6(a) | plasma (cell) / B-lymphocyte **;**<br>**A** B-cell<br>**I** splenocyte **/** b-cell / b-lymphocyte / beta cell | **1** |
| 6(b) | *any **two** from:*<br>**1** (myeloma cells) can divide by, <u>mitosis</u> **;**<br>**R** replicate<br>**A** plasma cells cannot divide by mitosis<br>**A** gives hybridoma cells their ability to divide by mitosis<br>**I** B-lymphocytes cannot divide by mitosis<br>**2** (myeloma / hybridoma, cells) divide, continually / repeatedly / AW **;**<br>**A** can undergo many cell cycles<br>**I** rapidly / quickly<br>**3** (myeloma / hybridoma cells) live, in culture / outside the body (for a long time) **;**<br>**4** extend the life of, <u>hybridoma</u> cells **;**<br>**A** do not self-terminate / no apoptosis / no cell death<br>**5** allows production of large quantities of (monoclonal), antibodies / antibody **;** | **2** |
| 6(c) | add, (named) virus / antigens from (surface of) virus / add pathogen (and check for binding) **;**<br>**I** 'of the disease'<br>**A** carry out ELISA test | **1** |
| 6(d) | modified antibody will be recognised as, self / not non-self **;**<br>**A** not foreign<br><br>(plasma cells of small mammals) produce humanised antibodies **;**<br><br>(so) antibodies do not need to be modified, after synthesis / before use **;**<br><br>(using human gene) prevents, an immune response / production of (anti-antibody) antibodies, in humans **;**<br>**A** prevents allergic reaction<br>**A** prevents (immune) rejection<br>AVP **;** *ref. to* advantage of harvesting cells from small mammals<br>e.g. only small quantities of cells need to be harvested<br>easy to extract the spleen from small mammal | **2** |

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