Cambridge Assessment International Education

# Cambridge International AS & A Level

**BIOLOGY** **9700/22**

Paper 2 AS Level Structured Questions **May/June 2022**

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 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **21** printed pages.

© UCLES 2022

**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 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.

© UCLES 2022

| |
|---|
| GENERIC MARKING PRINCIPLE 5:<br><br>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:<br><br>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<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. |

© UCLES 2022

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.

© UCLES 2022

**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 |

© UCLES 2022

**Examples of how to apply the list rule**

State **three** reasons…. [3]

| | | | |
|---|---|---|---|
| **A** | 1 Correct | ✓ | **2** |
| | 2 Correct | ✓ | |
| | 3 Wrong | × | |

| | | | |
|---|---|---|---|
| **B** | 1 Correct, Correct | ✓, ✓ | **3** |
| **(4 responses)** | 2 Correct | ✓ | |
| | 3 Wrong | ignore | |

| | | | |
|---|---|---|---|
| **C** | 1 Correct | ✓ | **2** |
| **(4 responses)** | 2 Correct, Wrong | ✓, × | |
| | 3 Correct | ignore | |

| | | | |
|---|---|---|---|
| **D** | 1 Correct | ✓ | **2** |
| **(4 responses)** | 2 Correct, CON (of 2) | ×, (discount 2) | |
| | 3 Correct | ✓ | |

| | | | |
|---|---|---|---|
| **E** | 1 Correct | ✓ | **3** |
| **(4 responses)** | 2 Correct | ✓ | |
| | 3 Correct, Wrong | ✓ | |

| | | | |
|---|---|---|---|
| **F** | 1 Correct | ✓ | **2** |
| **(4 responses)** | 2 Correct | ✓ | |
| | 3 Correct<br>CON (of 3) | ×<br>(discount 3) | |

| | | | |
|---|---|---|---|
| **G** | 1 Correct | ✓ | **3** |
| **(5 responses)** | 2 Correct | ✓ | |
| | 3 Correct<br>Correct<br>CON (of 4) | ✓<br>ignore<br>ignore | |

| | | | |
|---|---|---|---|
| **H** | 1 Correct | ✓ | **2** |
| **(4 responses)** | 2 Correct | × | |
| | 3 CON (of 2)<br>Correct | (discount 2)<br>✓ | |

| | | | |
|---|---|---|---|
| **I** | 1 Correct | ✓ | **2** |
| **(4 responses)** | 2 Correct | × | |
| | 3 Correct<br>CON (of 2) | ✓<br>(discount 2) | |

**I**

| Question | Answer | Marks |
|---|---|---|
| 1(a) | **I** *ref. to* resolution<br>*any **one** from:*<br>Fig. 1.1**A** is scanning (EM), qualified **;**<br>e.g. shows, surface / contour / 3-D, views<br>shows (only the), the outer / external, view (of microvilli)<br>idea of good focus with different depths<br>does not have stated feature of TEM (see mp2)<br><br>Fig. 1.1**B** is transmission (EM), qualified **;**<br>e.g. showing, 2D / flat, views (of, microvilli / mitochondria)<br>image in one plane<br>showing section through, mitochondria / microvilli / cell **I** thin<br>shows, internal view of cell / contents of cell / AW<br>does not have stated feature of SEM (see mp1)<br><br>scanning (EM) stated plus feature<br><u>and</u><br>transmission (EM) stated plus feature } **;** if Fig. 1.1, **A** / **B** not identified | **1** |
| 1(b) | *any **two** from: max 1 if stating to measure one of the sides of the figure*<br>(for each image) measure a number of microvilli and calculate a mean **;**<br><br>same units for actual and measured images / example given **;**<br>e.g. *if microvillus measurement is in mm*<br>convert, microvillus measured length to μm / actual length to mm<br>**R** if extra detail given is incorrect e.g. <u>divide</u> by 1000 for mm to μm<br><br>divide, microvillus / image, length by, actual length / AW / 1(μm) **;**<br>**A** *idea that* value for, microvillus / image, length is the magnification | **2** |
| 1(c)(i) | *any **two** from:*<br>(movement of substances) against concentration gradient / from low(er) to high(er) concentration ;<br>(protein has) binding site(s) **;**<br>specific **; A** description e.g. shape complementary to shape of substance<br>*can be in context of protein or binding site*<br>*ref. to* (binding causes protein), conformational change / change of shape **;** | **2** |

| Question | Answer | Marks |
|---|---|---|
| 1(c)(ii) | *any **two** from:*<br>**1** glucose is moving against a (concentration) gradient **;** AW e.g. low to high<br><br>**2** movement powered by inward movement of $Na^+$ **;** AW<br>**3** $Na^+$ movement (into cell from gut lumen) down an electrochemical gradient **or** down a ($Na^+$), concentration / diffusion, gradient<br>**or** by facilitated diffusion **;**<br>**A** diffusion if response includes *ref. to* the cotransport protein / cotranporter<br>4 AVP **;**<br>e.g. *idea that*, cotransport needed so that <u>all</u> glucose will be removed from gut lumen ora<br>facilitated diffusion of glucose will only be to equilibrium / AW<br>cotransporter has (specific) binding site for glucose<br>**I** cotransporter has a complementary shape<br>*idea that* there is no specific active uptake protein for glucose | **2** |
| 1(c)(iii) | increases / larger / large, surface area (over which glucose can enter cell per unit time) **;** **A** increases / higher / high, SA:V<br><br>*idea of* (so) more, transport / carrier / cotransport, proteins<br>**A** more cotransporters<br>**or**<br>more proteins, located in membrane / AW **;** **R** pump proteins<br><br>**A** *idea of* more space / places, where proteins can transport glucose | **2** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(d)</td><td>

*any **four** from:*

<table>
<tr><th>suggestion max 3</th><th>explanation</th></tr>
<tr><td>1 to replace, old / dead / damaged / injured, cells<br>or<br>to, repair / replace, damaged tissue ;<br><br>I repair cells<br>I replace old tissues</td><td rowspan="4">6 idea of <u>function</u> in context of mp1 or 2 or 3 ;<br>e.g. repair allows tissues to function<br><br>specialisation / differentiation, allows, cells / tissue, to function<br><br>genetically identical so cells can function as a tissue<br><br>look for other approaches e.g.<br>‘replace damaged cells that no longer function’ is mp1 and mp6<br>……<br>7 detail of function (intestines) ;<br><br>e.g. absorption (of, glucose / nutrients) production of digestive enzymes<br><br>pass absorbed, nutrients / AW, to blood<br><br>I nutrition</td></tr>
<tr><td>2 cells are produced that can, differentiate / become specialised (into intestinal cells);<br>I multipotent / AW<br><br>R if, stated / strongly implied that, <u>all</u> cells produced by mitosis become specialised</td></tr>
<tr><td>3 produce cells that are genetically identical ;<br>A clones<br><br>A identical / same, DNA / genetic material / genetic information</td></tr>
<tr><td>4 growth ; R growth of cells</td></tr>
<tr><td>5 renew / replenish / restore number of / AW, stem cells ;<br><br>I increase in stem cells</td><td>8 idea of development during, infancy / childhood ;<br><br>9 for, continued production / constant supply / AW, of intestinal cells<br>or<br>so that number of stem cells doesn’t decrease ;</td></tr>
</table>

</td><td>4</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 2(a)(i) | *any **two** from:*<br>oral rehydration (salts / solution / therapy) **;** **A** ORS / ORT<br>**A** rehydration therapy if *ref. to* 'drinking' stated within response<br><br>solution of / water with, glucose and salts **;**<br>**A** named example for salts e.g. sodium / potassium / citrate / chloride<br><br>AVP **;** e.g. antibiotics / doxycycline / tetracycline / furazolidone / choramphenicol / sulfaguanidine (*standard treatment in some countries*)<br>zinc treatment (*standard treatment for children in some countries*)<br>*ref. to* isolation | **2** |
| 2(a)(ii) | *any **two** from:*<br>decreases, recovery time **; A** cured more quickly<br>**I** helps recovery / reduces severity of disease<br><br>reduces time of / stops, diarrhoea production (containing pathogen) **;**<br><br>less likely to / AW, contaminate water **;**<br>reduced transmission of pathogen **;** AW e.g. breaks transmission cycle | **2** |
| 2(b)(i) | *allow antibody or mAb or Mab for monoclonal antibody*<br><br>**I** *ref. to* receptor **I** active site **I** combines / bonds<br>*any **two** from:*<br>specific / different, *(Vibrio* / pathogen) antigen-binding sites ***/*** binding sites for antigen **; R** if antibody described as enzyme<br>**A** (each) mAb binds to a, specific / particular, *(Vibrio* / pathogen) <u>antigen</u><br><br>(each mAb has) specific / different, tertiary structure / variable region(s) / primary structure / sequence of amino acids **;**<br><br>binding site and <u>antigen</u> have complementary shapes **;** | **2** |

| Question | Answer | Marks |
|---|---|---|
| 2(b)(ii) | *allow antibody or mAb or Mab for monoclonal antibody*<br>*any **three** from:*<br>**1** person **A,** has cholera O1 / is infected with *V. cholerae* O1<br>and person **B**, does not have cholera **;**<br><br>**A** *ref. to* person **A** testing positive for cholera O1 and person **B** testing negative to cholera<br><br>**2** tests are, valid / working, because, controls / bands 4, shows bands **;**<br><br>*person **A,** band / colour in area 3 because*<br>**3** anti-O1 (mobile) antibody binds (specific antigen on) *Vibrio* O1 **;**<br>**A** antigen-antibody (complex) 01 formed<br><br>**4** antigen-antibody (complex) O1 binds to immobilised antibody *ref. to* area 3 **;**<br>**R** if stated as, band / colour, in area 2<br><br>**5** person **B** (in test area 2 and 3) no bands form / no colour / no change, because no antibody binds with antigen / no antigen-antibody complexes formed **;** | **3** |
| 2(c)(i) | 95 / 95.1 (%) **; R** 95.0% | **1** |
| 2(c)(ii) | **I** *ref. to*, cheaper / no need for (highly) trained personnel / easier to use / easier to obtain results / accurate<br>**R** more accurate<br><br>*any **one** from:*<br>quicker to, obtain result / to do the test **; A** less time consuming<br>can carry out test in a greater variety of places / AW **;**<br>e.g. can be done at home<br>less labour intensive **;** AW e.g. only needs one person / can do it yourself<br>easier to test more people at one time / AW **;**<br>portable **;**<br>AVP **;** e.g. *idea of* easier to transport or distribute (to reach more people)<br>*ref. to*, safer / less risk, from pathogen<br>available to more people (*consequence of cheaper*)<br>*suggestion that* dipsticks are able to identify different, forms / strains | **1** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>
any two from:<br>
I ref. to two units v one unit or bigger v smaller (neutral points)
<table>
<tr><th>sucrose</th><th></th><th>fructose</th></tr>
<tr><td>disaccharide<br>R if incorrect monosaccharides stated</td><td>v</td><td>monosaccharide ;</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>non-reducing sugar ora</td><td>or</td><td>reducing sugar ; ora</td></tr>
<tr><td colspan="3">A described in terms of reaction with Benedict’s reagent</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>glycosidic bond present<br>R glucosidic</td><td>or</td><td>no glycosidic bond present ;</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>AVP ; e.g. always ring structure(s)<br><br>hydrolysed / broken down before used as, a respiratory substrate / an energy source</td><td>v<br><br>v</td><td>ring structure or straight chain form<br>can be used immediately as, a respiratory substrate / an energy source</td></tr>
</table>
</td><td>2</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 3(b)(i) | **I** three fatty acids<br>**A** fatty acid residue *for fatty acid*<br><br>*any **three** from:*<br>**1** glycerol **;**<br><br>**2** ester, bond / linkage, qualified **;** e.g. labelled on Fig. 3.2 / three ester bonds / ester bond between (O of) glycerol and (C of carboxyl of) fatty acid<br><br>**3** palmitate is <u>saturated</u> **or** oleate(s) are, <u>unsaturated</u> / <u>monounsaturated</u> **or**<br>two fatty acid(s) are, <u>unsaturated</u> / <u>monounsaturated</u>, <u>and</u> one is <u>saturated</u> **;**<br><br>**4** (each fatty acid has a) hydrocarbon chain **;**<br><br>**5** AVP **;** extra detail e.g.<br>*hydrocarbon chain* palmitate 15C <u>and</u> oleate 17C<br>palmitate,$CH_3(CH_2)_{14}$ <u>and</u> oleate, $CH_3(CH_2)_7CH{=}CH(CH_2)_7$<br><br>palmitate 16C and oleate 18C<br><br>*unsaturated fatty acid tail(s) / oleate*<br>*ref. to*, presence of one, C=C / (carbon-carbon) double bond<br>not the maximum number of, hydrogen atoms / hydrogens<br><br>*saturated fatty acid tail(s) / palmitate*<br>*ref. to* no, C=C / (carbon-carbon) double bond<br>maximum number of hydrogen atoms / hydrogens | **3** |

© UCLES 2022

| Question | Answer | Marks |
|---|---|---|
| 3(b)(ii) | *any **one** from:*<br>*idea that* provides greater energy per unit volume **;**<br>**A** higher calorific value / greater energy density<br>**R** produces more energy<br><br>less mass needed to provide same energy / low(er) mass to energy ratio **;**<br>ora higher energy to mass ratio<br><br>low(er) mass to volume ratio **;**<br><br>AVP **;** e.g. glycogen can only be stored in liver and muscles<br>glycogen is hydrated / uses water for storage, so mass increases<br>suggestion that more, areas / adipocytes / adipose tissue, in body to store triglycerides<br>(proportionately) more C-H bonds (to supply H for respiration)<br><br>*suggestion that* triglycerides provides insulation during flight (at heights)<br>more compact | **1** |
| 3(c) | closed, double (circulation / circulatory system) **;** | **1** |

| Question | Answer | Marks |
|---|---|---|
| 3(d) | **I** *ref. to* metabolism<br>*any **two** from:*<br>need more, / large quantities of, oxygen / glucose<br>**or**<br>more / large quantities, of, oxygen / glucose, delivered / reaches tissues / transported / AW<br>**or**<br>*idea of* enough, oxygen / glucose supplied to meet needs **;**<br><br>*idea that* heart pumps blood (to tissues more) efficiently **;**<br>e.g. forcefully / in greater volumes / more / with higher pressure / faster<br>*more oxygenated blood is mp2 only*<br><br>suggestion of reason for needing more oxygen or glucose **; I** migration<br>e.g. more active<br>fly / wing muscles<br>search for food longer<br>constantly moving / move for longer time<br><br>generate heat to maintain body temperature, qualified **;**<br>e.g. (generally) smaller size / larger SA:V<br><br>*ref. to* need to meet demands of carbon dioxide removal (from muscle action / respiration) **;**<br>*idea that more carbon dioxide produced (so must be removed)* | **2** |

© UCLES 2022

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(e)</td><td>note: only one mark for both pulmonary vessels
<table>
<tr><th>function of blood vessel</th><th>name of blood vessel</th></tr>
<tr><td>carries blood from the heart to the lungs</td><td rowspan="2">pulmonary, artery / arteries ;<br>pulmonary, vein / veins</td></tr>
<tr><td>carries blood to the heart from the lungs</td></tr>
<tr><td>carries blood from the heart to the rest of body</td><td><u>aorta</u> ; I artery</td></tr>
<tr><td>carries blood to the heart from the rest of body</td><td>I superior and inferior<br>or anterior and posterior<br>I vein<br><br>venae cavae / vena cava ;</td></tr>
</table></td><td>3</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 4(a) | **R** if choice given and one is incorrect<br><br>carbonic acid **;**<br><br>hydrogencarbonate (ions) **; A** bicarbonate (ions) | **2** |
| 4(b) | *any **one** from:*<br>similar / same, active site **;**<br>have the same catalytic amino acids ;<br>similar / same, tertiary structure **; A** same quaternary structure | **1** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(c)</td><td>
allow pre-RNA for primary transcript<br><br>
either exon or intron statement required for mp2 to 7, one mark each row<br>
any three from:
<table>
<tr><th>exons</th><th>introns</th></tr>
<tr><td colspan="2">1 both, are (nucleotide sequences that are) transcribed / form part of the primary transcript ;</td></tr>
<tr><td>2 (DNA/RNA) <u>coding</u> (sequences )<br>R coding genes<br>I exons have the genetic code</td><td>(DNA/RNA) <u>non-coding</u> (sequences)<br>R non-coding genes</td></tr>
<tr><td>3 (RNA exons) needed / involved / AW, in translation or for formation of, polypeptides / proteins / carbonic anhydrase</td><td>not involved in translation / AW</td></tr>
<tr><td colspan="2">if mps 2 and 3 not gained ‘exons code for proteins’ or ora 1 mark</td></tr>
<tr><td>4 not removed, from primary transcript / from RNA / during gene splicing / during RNA splicing</td><td>removed, from primary transcript / from RNA /during gene splicing / during RNA splicing</td></tr>
<tr><td>5 (join to) form mRNA / contain mRNA codons<br>A remain in mRNA</td><td>not part of mRNA / in primary transcript only</td></tr>
<tr><td>6 not involved in regulating activity of genes / AW</td><td>may have regulatory roles<br>A other suggestions for role</td></tr>
<tr><td>7 AVP e.g. (as part of mRNA) leave the nucleus / go to cytoplasm / go to ribosomes</td><td>AVP e.g. remain in nucleus</td></tr>
</table>
if <u>all</u> are differences and <u>all</u> statements are reversed (i.e. introns for exons and vice versa) max 2 marks
</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(d)</td><td>allow Hb or hb or Hgb for haemoglobin<br>two marks for points in left column or two marks for points in right column
<table>
<tr><td>cytoplasm / cytosol ;</td><td>(bound to) cell surface membrane ;</td></tr>
<tr><td>close to haemoglobin (for $H^+$ uptake)<br>R in / on / with, hb<br>or<br>idea of being dispersed within cell because haemoglobin is distributed throughout ;</td><td>close to, anion exchanger / transport protein, for (easy) exit of hydrogen carbonate (ions) ;</td></tr>
<tr><td>quick for hydrogen carbonate (ions) to be transported out of cell / AW or<br>$H^+$ (from dissociation) binds rapidly to haemoglobin or cytoplasm provides water for reaction to form carbonic acid ;</td><td>able to, hydrate / react with, carbon dioxide as it enters cell ;</td></tr>
</table>
if stated cytoplasm <u>and</u> cell surface membrane, one mark<br>reason can be taken from either column if correctly linked, one mark</td><td>2</td></tr>
<tr><td>4(e)</td><td>exocytosis ;</td><td>1</td></tr>
<tr><td>4(f)</td><td>any three from:<br>1 acetazolamide / inhibitor, binds / attaches / AW, to, allosteric site / site other than active site ; R alternative active site<br><br>2 (which) changes, shape / tertiary structure / 3-D structure, of active site ;<br>A active site distorted I protein structure<br><br>allow ecf for mp3 and 4 if competitive described (to max 2)<br>3 substrate(s) / $CO_2$ / $HCO_3^-$, cannot, enter / bind to / fit in / AW, active site ;<br>A active site no longer complementary to, substrate / AW<br>A enzyme substrate / ES, complexes cannot form<br>A ESCs cannot form<br>I ‘substrate / $CO_2$ / $HCO_3^-$ / ‘cannot bind to enzyme’ without a link to active site<br>4 product, not formed / released ; A named product<br><br>5 ref. to acetazolamide / inhibitor, leaves, allosteric site / enzyme ;<br>I reversibly binds</td><td>3</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 5(a) | *any **one** from:* **I** too small<br>presence of ciia **;** **A** ciliated, cells / epithelial cells / epithelium<br><br>AVP **;** e.g. *suggestion that* mucus on surface makes detail not easily seen | **1** |
| 5(b) | epithelium has goblet cells and ciliated epithelial cells **;**<br>**A** ciliated cells<br>**A** two different cell types present<br><br>**I** *ref. to* cell division<br><br>*ref. to* staining **;** e.g. use of stains gives different, shades / colours<br>differential staining<br>one cell type more neutral / acidic<br>different parts of cells stain differently<br><br>*idea of* cells have different densities **;**<br>e.g. *idea of* more structures / larger nucleus, gives greater density / AW<br>**R** no cell structures *for lighter cell*<br>**I** *ref. to* number of cilia<br>(sectioning may include) more of nucleus so, affects light penetration / makes cell darker ora<br><br>AVP **;** *idea of* different components in cells appearing, darker / lighter | **2** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(c)</td><td>
any three from:
<table>
<tr><th>A</th><th></th><th>B / cartilage</th></tr>
<tr><td colspan="3">max two for structure</td></tr>
<tr><td>smooth muscle / composed of smooth muscle cells or<br>no chondrocytes</td><td>or</td><td>no smooth muscle cells<br>or<br>has chondrocytes ;</td></tr>
<tr><td>cells close together</td><td>or</td><td>cells, (more) isolated / in gaps / in lacunae ;</td></tr>
<tr><td>cells, spindle shaped / elongated / AW</td><td>or</td><td>cells (more) rounded / AW ;</td></tr>
<tr><td>AVP structure e.g. not surrounded by, perichondrium / AW<br>contains blood vessels</td><td>or</td><td>surrounded by, perichondrium / AW<br>no blood vessels ;</td></tr>
<tr><td colspan="3">function</td></tr>
<tr><td>contractile / contracts (and relaxes) I recoil<br>A bronchi walls contract<br>R bronchi contract</td><td>or</td><td>non-contractile ;</td></tr>
<tr><td>changes diameter of airways<br>A controls size of lumen</td><td>or</td><td>protective / support ;<br>A described e.g. prevents collapse of, bronchus or<br>keeps bronchus open</td></tr>
</table>
if incorrectly quotes A as the cartilage, use right hand column to allow one mark max (ecf)
</td><td>3</td></tr>
</table>

© UCLES 2022

| Question | Answer | Marks |
|---|---|---|
| 6(a) | *any **three** from:*<br>at (phloem) source, mineral ion entry (with water), from xylem / through plasmodesmata from companion cells **;**<br><br>dissolved in water / as solutes in water / in solution / in sap solution **;**<br>*in context of entry from xylem or within phloem sap*<br><br>(transport) as part of mass flow **;** *must be in context of phloem*<br>flow down a pressure gradient / AW **;**<br>**R** differences in pressure gradient<br>**R** from high pressure gradient to low pressure gradient<br><br>AVP **;** e.g. suggestion that mineral ions are needed for transport of some assimilates (e.g. complexed with)<br>*idea of* reallocation of resources / arrive at (phloem) source and are moved to other parts, for use / when needed **;** | **3** |
| 6(b) | sieve, plates / pores **;** **A** perforated end plates / end plates with pores<br>**I** plasmodesmata<br>periphery / edge / AW **;**<br>companion **;** **A** transfer | **3** |