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CAMBRIDGE
International Education

# Cambridge International AS & A Level

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

Paper 2 AS Level Structured Questions **October/November 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 October/November 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:<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 | <u>'List rule' guidance</u><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 standard isation 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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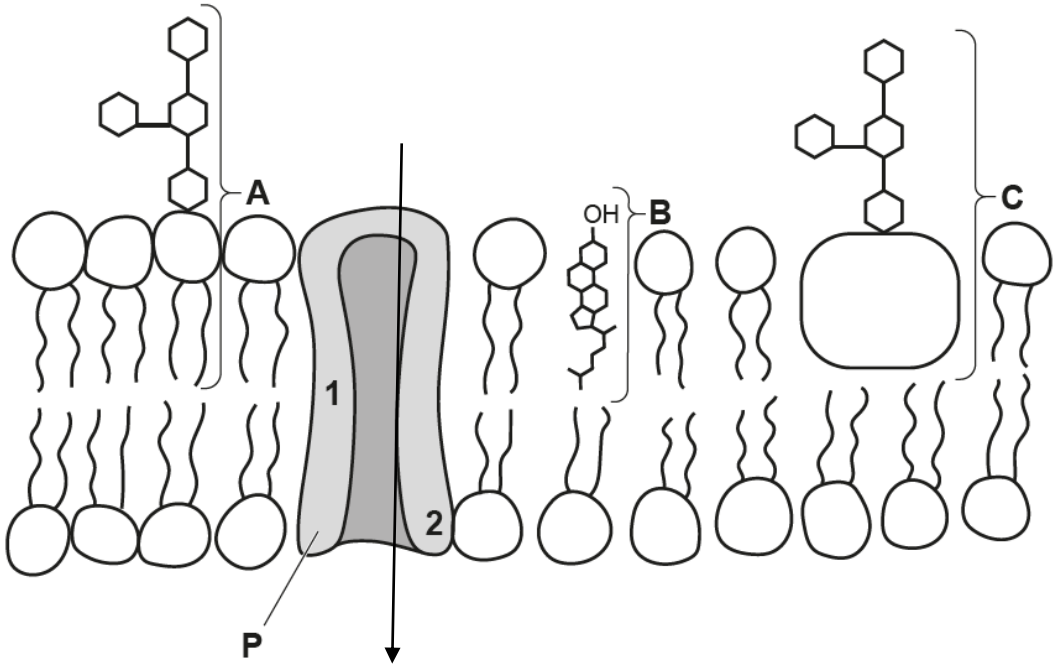
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**Mark scheme abbreviations**

| | |
|---|---|
| **;** | 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 |

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| Question | Answer | Marks |
|---|---|---|
| 1(a) | **A** glycolipid ;<br>**B** cholesterol ;<br>**C** glycoprotein ; | **3** |
| 1(b) | <br>1 arrow through protein ;<br>2 direction of arrow correct ; | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 1(c) | *any **three** from:*<br>fluidity (of membrane) increases **;**<br><br>unsaturated fatty acids have double bonds **;**<br><br>(double bonds) cause the fatty acid chain to, kink / bend / AW **;**<br><br>unsaturated fatty acids cannot lie as close together as saturated fatty acids **A ora**<br>**or**<br>*ref. to* increased distance between phospholipids / AW **;**<br><br>*ref. to* weakening the hydrophobic interactions between, fatty acid chains / cholesterol **;** | **3** |
| 1(d) | *any **one** from:*<br>position **1** has amino acids with, hydrophobic / non polar / AW, R-groups **;**<br>position **2** has amino acids with, hydrophilic / polar / ionic / AW, R-groups**;**<br><br>**A** *ref. to* amine and carboxyl groups as appropriate | **1** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | *any **two** from:*<br>(each haem contains) an, iron ion / ferrous ion / $Fe^{2+}$ **;** **A** iron / iron atom<br><br>(each haem) binds to / AW, an oxygen molecule / two oxygen atoms **;**<br>**A** forms a bond *only if*, iron ion / ferrous ion / $Fe^{2+}$, stated | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 2(b) | *any **three** from:*<br>less carbon dioxide diffuses into red blood cells **;**<br>less carbon dioxide reacts with water **;**<br>less carbonic acid is formed **;**<br>less, dissociation of carbonic acid / formation of hydrogen ions and hydrogen carbonate ions **;**<br>less haemoglobinic acid is formed **;**<br>**A** description e.g. $H^+$ binds to haemoglobin<br>less oxygen (released from haem) diffuses out of red blood cells (to respiring tissues) **;**<br>*ref. to* carbaminohaemoglobin **;**<br>AVP **;** e.g. *ref. to* change in shape of haemoglobin when $H^+$ binds | **3** |
| 2(c)(i) | *idea that* blood vessel **X** carries (oxygenated blood) at high pressure (to body tissues) **;**<br>**A** *ref. to* systemic circulation<br><br>*any **two** from:*<br>*difference*<br>high proportion of elastic fibres (and low proportion of smooth muscle) **;**<br><br>*explanation*<br>(elastic fibres allow **X** to) expand / stretch, qualified **;**<br>e.g. to accommodate / AW, blood from ventricular, systole / contraction<br>with, surges / pulses, of blood leaving heart<br>to prevent, bursting / rupture<br><br>recoil of elastic fibres, detail **;**<br>e.g.to allow surges / pulses, to continue<br>*idea of* allowing continued flow of blood to tissues<br>maintains, onward pressure / high pressure of blood<br><br>*if no marks gained in this section allow one mark for:*<br>*stretch and recoil with one detail*<br>***or***<br>*ref. to two correct details but stretch and recoil not stated* | **3** |

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| Question | Answer | Marks |
|---|---|---|
| 2(c)(ii) | *allow, impulses / wave of excitation, for electrical impulses* **R** nerve impulses *once and allow* ***ecf***<br>*must attempt AVN <u>and</u> Purkyne tissue to gain max*<br><br>*any* ***four*** *from:*<br>both involved in, co-ordination / control, of, systole / contraction, of, heart / heart muscle / cardiac muscle / ventricles **;**<br><br>*AVN*<br>only pathway for impulses to travel from atria to ventricles **;** AW<br>**A** impulses must pass through AVN for ventricular, contraction / systole<br><br>allow, a delay **/** 0.1 s, for impulse to pass from atria to ventricles **;**<br><br>so, ventricles contract after atria contract / ventricular systole occurs after atrial systole **;**<br><br>allows atria to (fully) empty before, ventricles (begin to) contract / ventricular systole<br>**or**<br>allows blood to fill ventricles before ventricular, contraction / systole **;**<br><br>*Purkyne tissue*<br>carries / transmits / AW, impulse(s), (down septum), to base of ventricles / through walls of the ventricles **;**<br><br>for ventricular systole / AW **;**<br><br>ventricular muscles contract / AW, together / at same time / simultaneously / from the base upwards / from apex of heart **;** | **4** |

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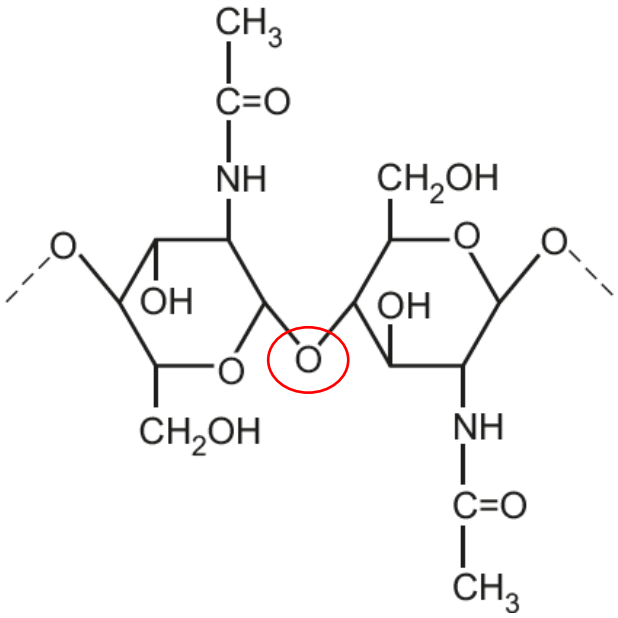
| Question | Answer | Marks |
|---|---|---|
| 3(a) | **one** similarity **;**<br>e.g. substrate binds to active site<br>enzyme-substrate complex forms<br>product leaves active site<br>interaction does not alter enzyme for re-use<br>lower activation energy<br>specific to one or very similar substrate(s)<br>interaction can be affected by, action of inhibitors / pH / AW<br><br>**one** difference **;**<br>e.g. induced-fit **ora** for lock-and-key<br>active site not fully complementary to substrate<br>change in, conformation / shape, of active site / AW *context of binding substrate or after product release*<br>less specificity to substrate | **2** |
| 3(b)(i) | orange / brown / amber **;**<br>**A** yellow-brown, yellow-orange | **1** |
| 3(b)(ii) | *any **three** from*:<br>phosphorylase (in extract) catalyses addition of glucose 1-phosphate to starch added to extract **;**<br>more starch is synthesised by phosphorylase as time progresses / AW **;**<br>iodine solution added to mixture turns a, blue / black / blue-black, colour (in the presence of starch) **;**<br>the more starch present in the mixture, the, darker / more intense, the, colour / shade **;**<br>the darker the colour (of the positive result) the less light passes through, mixture / sample **;**<br>the darker the colour / AW, the higher the absorbance (reading of the colorimeter) **;** | **3** |
| 3(b)(iii) | *ref. to* breakdown of starch catalysed by the enzyme / reaction in Fig. 3.1 goes in the opposite direction **;**<br><br>AVP **;** e.g. *ref to* equilibrium shift<br>*ref. to* glucose 1-phosphate has run out<br>decrease in concentration of starch, qualified with *ref. to* iodine solution | **1** |

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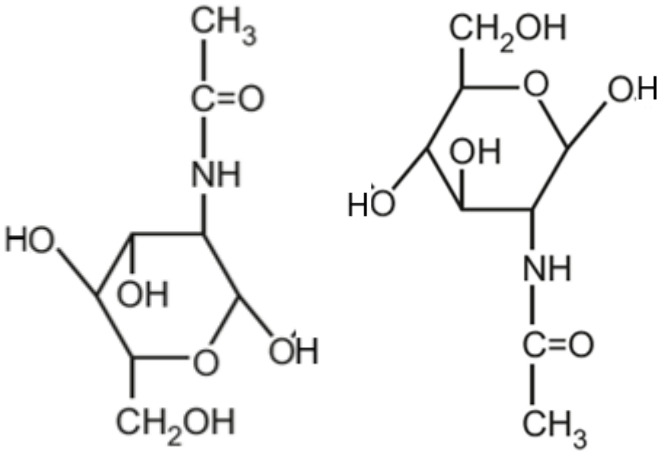
| Question | Answer | Marks |
|---|---|---|
| 3(c) | *any **three** from:*<br>reduction in activity of phosphorylase (at all concentrations) ; **ora** higher throughout with caffeine<br>$V_{max}$ not reached ;<br>*ref. to* plateau at a (much) lower activity ;<br>calculated $K_m$ value with caffeine is the same as without caffeine ;<br>use of data from the graph to support conclusion ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | <br>correct glycosidic bond circled ; | **1** |

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| Question | Answer | Marks |
|---|---|---|
| 4(a)(ii) |   –OH group shown on the monomer where the glycosidic bond connected the two monomers (C1) ; –OH shown on C4 ; | **2** |
| 4(b) | *any **four** from:* *ref. to* filtering helps prevent / AW, cholera ; filtering water removed copepods (with bacteria on surface) from water ; some bacteria were able pass through fabric / bacteria were found living free in water / some copepods were small enough to pass through fabric ; cholera transmission could be from, other sources / food ; people who filter water may have better personal hygiene ; **A** examples e.g. washing hands AVP ; e.g. differences in other water treatment methods e.g. boiling water | **4** |

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| Question | Answer | Marks |
|---|---|---|
| 4(c)(i) | *any **one** from:*<br>wash hands, qualified **;**<br>e.g. more frequently<br>after, urination / defecation / using the toilet **I** non-scientific terms<br>before preparing food<br>before handling utensils<br>thoroughly / with soap / antibacterial gel<br><br>avoid eating, crops / food, grown with faeces used as fertiliser **;**<br>wash fruit / vegetable (in, uncontaminated / AW, water) **;**<br>cover food to prevent flies landing / kill flies before they land on food **;**<br>AVP **;** e.g<br>don't share hand towels<br>use disposable hand towels<br>keep fingernails short | **1** |
| 4(c)(ii) | *any **two** from:*<br>*ref. to* active transport / *ref. to* efflux pumps **;** *in correct context*<br>tetracycline transported out of the cell **;**<br>AVP **;** e.g. substance pumped out combined with tetracycline<br>(membrane) enzyme that breaks down tetracycline before entry to cell | **2** |
| 4(c)(iii) | *any **two** from:*<br>vaccines may contain more than one antigen (so more than one type of antibody is present) **;**<br>multiple mutations are needed to evolve, immune evasion / described**;**<br>vaccines given to people before infection so secondary immunity acts quickly to kill pathogen before mutations arise **;**<br>antibiotics used when person already infected so large population **; ora**<br>more likely to be a mutation which causes resistance **; ora**<br>antibiotics may target only one site in a bacterial cell **;**<br>antibiotics more likely to be misused **;**<br>AVP **; ;** | **2** |

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| Question | Answer | Marks |
|---|---|---|
| 5(a)(i) | *any **one** from:*<br>water ;<br>mineral ions ; **A** any named appropriate ion<br>AVP ; e.g. plant hormone | **1** |
| 5(a)(ii) | lignin ; | **1** |
| 5(b)(i) | *any **three** from:*<br>as temperature increases, rate of water vapour loss from leaf increases ;<br>**A** transpiration for water vapour loss<br>*idea that* more heat energy absorbed by leaf ;<br>more (heat) energy to evaporate water molecules / increased temperature for latent heat of vaporisation ;<br>**A** more energy to break hydrogen bonds<br>higher rate of evaporation / AW, from, surfaces / walls, of spongy mesophyll cells ;<br>water vapour molecules have more kinetic energy ;<br>higher rate of diffusion of water vapour out of leaf / steeper water potential gradient ;<br>more stomata are open at higher temperatures so more water vapour is able to diffuse out of leaf ; | **3** |
| 5(b)(ii) | *any **one** from:*<br>cotton leaves have fewer stomata (per unit area) ;<br>*idea that* cotton leaves have a thicker (waxy) cuticle ;<br>cotton leaves have trichomes ;<br>**A** hairs for trichomes<br>cotton leaves are curled ;<br>**A** rolled / folded<br>cotton leaves have, sunken stomata ;<br>**A** other examples e.g. stomata in, grooves / crypts / chambers / pits<br>cotton leaves have, multilayered epidermis / hypodermis / thick walled epidermis ;<br>AVP ; e.g. suggestion that cotton leaves only have stomata on lower epidermis<br>smaller stomatal aperture | **1** |
| 5(c)(i) | *any **one** from:*<br>more than one nucleus in each cell / more chromosomes ;<br>larger cells ;<br>more organelles ; | **1** |

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| Question | Answer | Marks |
|---|---|---|
| 5(c)(ii) | any one from:<br>nucleus will contain more chromosomes / more than 2 copies of each chromosome ;<br>**A** more DNA molecules / more chromatin<br>AVP ; e.g. *ref. to* polyploidy<br>(proportionately) larger nuclei | **1** |

| Question | Answer | Marks |
|---|---|---|
| 6(a)(i) | gene ; | **1** |
| 6(a)(ii) | transcribed / template, strand ; | **1** |
| 6(a)(iii) | ribosome ; **I** 70S / 80S | **1** |
| 6(a)(iv) | weakens / AW, bacterial <u>cell wall</u> ;<br>cell cannot maintain turgor / AW ;<br>leads to (osmotic) lysis / AW ; | **2** |
| 6(b)(i) | flattened cells / AW ;<br>short diffusion distance, (for gas exchange / described) ; | **2** |
| 6(b)(ii) | stretch / expand, on inhalation, to prevent alveoli bursting / rupturing / overstretching ;<br>recoil on exhalation to help expel air from the lungs ;<br><br>*if no marks gained, allow one mark for stretch and recoil* | **2** |

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