

# Cambridge International AS & A Level

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**MARINE SCIENCE****9693/21**

Paper 2 AS Level Data-handling and Investigative Skills

**May/June 2026****MARK SCHEME**Maximum Mark: 75

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**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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This document consists of **32** printed pages.

**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: <ul style="list-style-type: none"> <li>the specific <b>content</b> defined in the mark scheme</li> <li>the specific <b>skills</b> defined in the mark scheme or in the level descriptions</li> <li>the <b>standard of response</b> required as exemplified by the standardisation scripts.</li> </ul>                                                                                                                                                                                                                                                                                    |
| 2 | Examiners must award <b>whole marks</b> (not half marks, or other fractions).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 3 | Examiners must award marks <b>positively</b> . This means that: <ul style="list-style-type: none"> <li>marks are not deducted for errors or omissions</li> <li>marks are awarded for correct/valid answers as defined in the mark scheme and also for <b>other valid answers</b> which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate</li> <li>the quality of spelling, punctuation and grammar are judged <b>only</b> when the mark scheme indicates that these features are <b>specifically assessed</b> in the question. However, the meaning of all responses must be unambiguous.</li> </ul> |
| 4 | Examiners must <b>consistently</b> 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 <b>full range of marks</b> 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 <b>must not</b> award marks with grade thresholds or grade descriptions 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 | <p><u>'List rule' guidance</u></p> <p>For questions that require <b><i>n</i></b> responses (e.g. State <b>two</b> reasons ...):</p> <ul style="list-style-type: none"> <li>• The response should be read as continuous prose, even when numbered answer spaces are provided.</li> <li>• Any response marked <i>ignore</i> in the mark scheme should not count towards <b><i>n</i></b>.</li> <li>• Incorrect responses should not be awarded credit but will still count towards <b><i>n</i></b>.</li> <li>• Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should <b>not</b> 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.</li> <li>• Non-contradictory responses after the first <b><i>n</i></b> responses may be ignored even if they include incorrect science.</li> </ul> |

**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.

**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**

| <b>Annotation</b>                                                                   | <b>Meaning</b>                                                                 |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
|    | correct point or mark awarded                                                  |
|    | incorrect point or mark not awarded                                            |
|    | information missing or insufficient for credit                                 |
|    | allow or accept                                                                |
|  | incorrect or insufficient point ignored while marking the rest of the response |
|  | contradiction in response, mark not awarded                                    |
|  | benefit of the doubt given                                                     |
|  | error carried forward applied                                                  |
|  | maximum mark reached                                                           |
|  | Point already given                                                            |

| Annotation                                                                        | Meaning                                                                                                                    |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
|  | power of ten error                                                                                                         |
|  | incorrect point or mark not awarded                                                                                        |
|  | rounding error                                                                                                             |
|  | point has been noted, but no credit has been given<br>or<br>blank page seen                                                |
|  | response is too vague or there is insufficient detail in response                                                          |
|  | marking point 1 or marking point a is awarded. Used to mark against a particular marking point from an extended answer MS  |
|  | used to highlight parts of an answer / incorrect idea / irrelevant to question                                             |
|  | used to highlight parts of an extended response / incorrect idea / irrelevant to question                                  |
|  | key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen |
| ruler                                                                             | allows lengths to be measured                                                                                              |
| multi-line overlay                                                                | overlays graphs                                                                                                            |

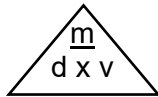
This mark scheme will use the following abbreviations:

|                                |                                                                                                           |
|--------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>;</b>                       | separates marking points                                                                                  |
| <b>/</b>                       | separates alternatives within a marking point                                                             |
| <b>()</b>                      | contents of brackets are not required but should be implied / the contents set the context of the answer  |
| <b>R</b>                       | reject                                                                                                    |
| <b>A</b>                       | accept (answers that are correctly cued by the question or guidance you have received)                    |
| <b>I</b>                       | ignore (mark as if this material was not present)                                                         |
| <b>AW</b>                      | alternative wording (where responses vary more than usual, accept other ways of expressing the same idea) |
| <b>AVP</b>                     | alternative valid point (where a greater than usual variety of responses is expected)                     |
| <b>ORA</b>                     | or reverse argument                                                                                       |
| <b><u>underline</u></b>        | actual word underlined must be used by the candidate (grammatical variants excepted)                      |
| <b><u>dotted underline</u></b> | answer must include an equivalent word or statement but actual word(s) underlined are not needed          |
| <b>MAX</b>                     | indicates the maximum number of marks that can be awarded                                                 |
| <b>AND</b>                     | statements on both sides of the <b>AND</b> are needed for that mark                                       |
| <b>OR</b>                      | separates two different routes to a mark point and only one should be awarded                             |
| <b>ECF</b>                     | error carried forward (credit an operation from a previous incorrect response)                            |

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| Question | Answer                                                                                                 | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|--------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(a)(i)  | $(3800 \times 0.35) = 1330 \text{ (km}^3\text{)} ;$<br>answer to 2 SF = $1300 \text{ (km}^3\text{)} ;$ | <b>2</b> | <p><b>A</b> 2 marks for 1300 only<br/> <b>A ECF</b> for correct SF of division instead of multiplication WHEN WORKING IS SHOWN as follows:</p> <p>where <math>3800 / 350 = 10.857 \rightarrow 11 \times \checkmark</math><br/>           where <math>3800 / 0.35 = 10857 \rightarrow 11000 \times \checkmark</math></p> <p><b>QUICK GUIDE FOR ANSWERS WITHOUT (CHECKING) WORKING:</b></p> <p>1300 = 2 marks<br/>           1330 = 1 mark (<b>MP1</b>✓ <b>MP2</b>×)<br/>           1 300 000 = 1 mark (<b>MP1</b>× <b>MP2</b>✓)<br/>           1 330 000 = 0 mark (<b>MP1</b>× <b>MP2</b>×)<br/>           130 to <u>any</u> <math>10^x = 1</math> mark (<b>MP1</b>× <b>MP2</b>✓)<br/>           13 = 1 mark (<b>MP1</b>× <b>MP2</b>✓)<br/>           1.3 = 1 mark (<b>MP1</b>× <b>MP2</b>✓)<br/>           0.13 = 1 mark (<b>MP1</b>× <b>MP2</b>✓)</p> |

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| Question  | Answer                                                  | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------|---------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(a)(ii)  | 925 (kg m <sup>-3</sup> ) ;                             | 2     | <p><b>A</b> 930 (correct answer to 2 SF) for 2 marks<br/> <b>A</b> 14.8 / 0.016 for 1 mark<br/> <b>A</b> triangle or equation (including valid rearrangements) with letters / words:<br/> e.g. density = mass / volume<br/> e.g. <math>d = m / v</math></p>  <p><b>A</b> 14.8 x 0.016 = 0.2368 <b>MP1</b> × <b>MP2</b> ✓ <b>ECF</b><br/> <b>A</b> <b>ECF</b> for simple transcription error e.g. single digit copied incorrectly or decimal point in wrong place<br/> <b>MP1</b> × <b>MP2</b> ✓ <b>ECF</b><br/> e.g. 14.8 / 16 = 0.925 <b>MP1</b> × <b>MP2</b> ✓ <b>ECF</b><br/> e.g. 14.8 / 0.076 = 194.7 <b>MP1</b> × <b>MP2</b> ✓ <b>ECF</b></p> <p>I use of –ve symbol in answer<br/> note use of • as multiply symbol is fine</p> |
| 1(a)(iii) | any value greater than value given for <b>(a)(ii)</b> ; | 1     | <p><b>A</b> 925<br/> <b>A</b> 925 &lt; <b>BOD</b><br/> <b>A</b> <b>ECF</b><br/> <b>R</b> negative values<br/> <b>IF</b> no answer given to <b>1(a)(ii)</b>:<br/> <b>A</b> 925 to 1200 <b>BOD</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(a)(iv) | <p><b>1</b> (ice) acts as a <u>thermal</u> insulator <b>AW</b> ;</p> <p><b>2 linked explanation:</b> <i>idea</i> this reduces further heat loss from sea water beneath / prevents sea freezing solid, (below the ice / to the sea bed) ;</p> <p><b>3</b> (ice) provides a, habitat / shelter, for (marine) organisms ;</p> <p><b>4 linked explanation:</b> to hunt from <b>OR</b> allows animals to rest out of water / escape (predators) / breeding / reproduce / nursery / <b>AVP</b> ;</p> | <b>4</b> | <p>marks are independent – explanations can be awarded if MP1 / 3 not clear<br/>mark whole answer as continuous prose – linked explanations can be in different parts.</p> <p><b>I</b> any ref to provide nutrients / iron ions etc (Q relates to importance of <u>ice floating</u>)</p> <p>hold out for idea of thermal insulation, can give if answer discusses temperature</p> <p><i>idea of</i> maintains <u>suitable</u> temperature / liquid water below the ice<br/><b>I</b> keeps water warm below<br/><b>I</b> average / consistent<br/><b>A</b> ref to stops organisms freezing</p> <p><b>A</b> appropriate named organisms inc. algae<br/><b>A</b> ecosystem for habitat</p> <p><b>I</b> home / land<br/><b>I</b> shade<br/><b>I</b> surface without further clarification of the benefit</p> <p>e.g. surface for algae to <u>grow on</u> to for 2 marks or krill laying eggs</p> <p><b>I</b> tool for hunting – can be flipped to tip prey off<br/><b>I</b> shade for animals<br/><b>I</b> support / protect unqualified (protect from predators is ok)</p> |

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| Question | Answer                                                                                                                                                                                                                    | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(b)(i)  | <p><i>any 1 from:</i><br/> <i>idea that</i> (some / enough of the) ice had <u>melted</u> (to reduce the depth of the iceberg) ;</p> <p>weathering of ice (could be linked to cause of the weathering e.g. currents) ;</p> | <b>1</b> | <p><b>I</b> global warming / climate change/ El Nino – need impact on the iceberg</p> <p><b>I</b> erosion</p> <p><b>A</b> any valid suggestions causing the iceberg to reduce in size or break up e.g. large chunks broken off / break apart</p> <p><b>A</b> reference to sea levels rising</p> <p><b>A</b> ref. to, <u>increasing</u> strength / <u>change in</u> direction, of currents</p> <p><b>A</b> earthquakes / earth tremors BOD</p> <p><b>I</b> tectonic activity</p> |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                               | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(b)(ii) | <p>any <b>3</b> from:</p> <p><b>1</b> (driven by) wind ;</p> <p><b>2</b> differences in density of water ;</p> <p><b>3</b> (density) differences due to / changes in, (water) temperature ;</p> <p><b>4</b> (density) differences due to / changes in, salinity ;</p> <p><b>5</b> shape of the, sea bed / coastline ;</p> <p><b>6</b> Coriolis forces / Earth's rotation ;</p> <p><b>7</b> AVP ;</p> | <b>3</b> | <p><b>I</b> tsunami / ref. to tectonic plates moving</p> <p><b>A</b> ref. storms / trade winds</p> <p><b>I</b> El Nino / La Nina</p> <p><b>R</b> incorrect statements about density <i>e.g. warmer water more dense</i></p> <p><b>A</b> description of differences for <b>MP3</b> – ‘density’ required for <b>MP2</b> only</p> <p><b>A</b> ref. to thermohaline circulation if none of MP 2 / 3 / 4 not given</p> <p><b>I</b> upwelling</p> <p><b>A</b> Coriolis effect</p> <p><i>e.g. large rivers / tides / tidal currents / <u>gravitational pull</u> of moon</i></p> <p><b>I</b> gravitational pull of Earth</p> <p><b>I</b> magnetic fields</p> <p><b>I</b> ref to global conveyor</p> |

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| Question                                   | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks                     | Guidance                                                                                                      |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------|--------------------------------------------|----------------------------|-------------------------------|---------|-----------------------------|-----------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(c)(i)                                    | <i>independent variable:</i> <u>concentration</u> of (dissolved), iron / ions / iron ions ;                                                                                                                                                                                                                                                                                                                                                                                              | 1                         | <b>I</b> amount<br><b>A</b> number of, ions / iron ions, per volume<br>the answer MUST describe concentration |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1(c)(ii)                                   | <i>up to 2 marks from any row below:</i> <table><tr><th><i>dependent variable</i></th><th><i>how to measure</i></th></tr><tr><td><u>volume of</u> oxygen produced ;</td><td>gas syringe / (displacement of water) in measuring cylinder ;</td></tr><tr><td><u>concentration of</u> dissolved oxygen ;</td><td>(dissolved) oxygen meter ;</td></tr><tr><td>increase in length of plant ;</td><td>ruler ;</td></tr><tr><td>increase in mass of plant ;</td><td>balance ;</td></tr></table> | <i>dependent variable</i> | <i>how to measure</i>                                                                                         | <u>volume of</u> oxygen produced ; | gas syringe / (displacement of water) in measuring cylinder ; | <u>concentration of</u> dissolved oxygen ; | (dissolved) oxygen meter ; | increase in length of plant ; | ruler ; | increase in mass of plant ; | balance ; | 2 | <b>A</b> rate of photosynthesis<br><b>A</b> 1 divided by time taken to produce a fixed volume of gas OR volume produced divided by time taken (to collect)<br><br><b>Note:</b> to measure rate need to measure time as well as volume / bubbles of oxygen / length etc.<br><br><b>A</b> volume or number of bubbles<br><b>I</b> ref to amount<br><br><b>note:</b> how to measure mark depends on matching an appropriate dependent variable |
| <i>dependent variable</i>                  | <i>how to measure</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |                                                                                                               |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <u>volume of</u> oxygen produced ;         | gas syringe / (displacement of water) in measuring cylinder ;                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |                                                                                                               |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <u>concentration of</u> dissolved oxygen ; | (dissolved) oxygen meter ;                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |                                                                                                               |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| increase in length of plant ;              | ruler ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |                                                                                                               |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| increase in mass of plant ;                | balance ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |                                                                                                               |                                    |                                                               |                                            |                            |                               |         |                             |           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |

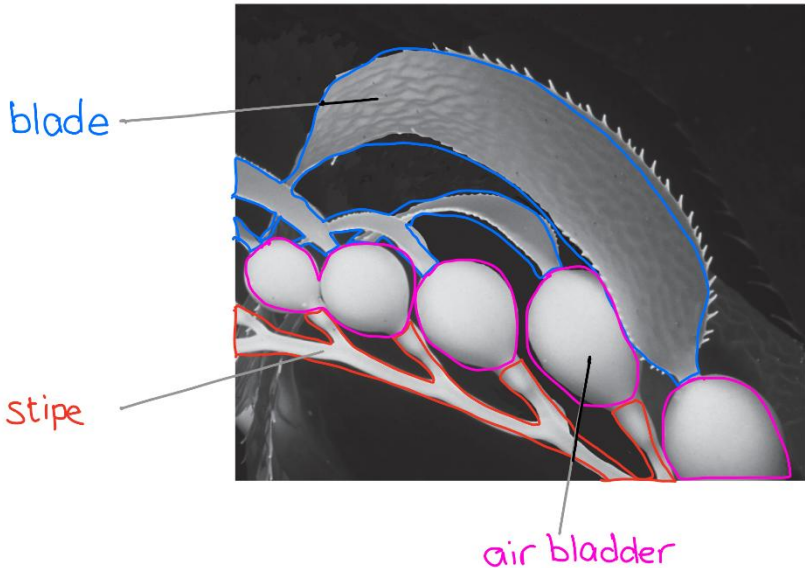
| Question                        | Answer                                                                                                                                                                                                                                                                                                                                    | Marks                        | Guidance                     |              |  |                                 |                       |  |   |          |                        |  |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|--------------|--|---------------------------------|-----------------------|--|---|----------|------------------------|--|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(c)(iii)                       | <table> <tr> <th><i>standardised variable</i></th><th><i>suitable value to use</i></th><th><i>units</i></th><th></th></tr> <tr> <td>Antarctic sea water temperature</td><td>–2 to 5      <b>AND</b>      °C</td><td></td><td>;</td></tr> <tr> <td>salinity</td><td>5 to 40      <b>AND</b>      ppt</td><td></td><td>;</td></tr> </table> | <i>standardised variable</i> | <i>suitable value to use</i> | <i>units</i> |  | Antarctic sea water temperature | –2 to 5 <b>AND</b> °C |  | ; | salinity | 5 to 40 <b>AND</b> ppt |  | ; | 2 | <p><b>A</b> unit with value, but if contradiction then unit stated in units space is the unit marked</p> <p><b>A degrees celsius</b><br/> <b>R</b> °C <b>or</b> alone <b>or</b> °C <b>or</b> Celsius <b>or</b> degrees<br/> <b>R</b> Fahrenheit / °F<br/> <b>A</b> Kelvin for temp units <b>AND</b> 271–278 for temperature value</p> <p><b>A</b> PPT for ppt, or combinations of capitals and lower case<br/> <b>A</b> ‰ <b>or</b> g dm<sup>-3</sup> <b>or</b> g per dm<sup>3</sup> for ppt<br/> <b>A</b> g / kg or g / litre<br/> <b>A</b> % for salinity units <b>IF</b> value ≤ 4<br/> <b>A</b> ppts (<b>BOD</b>)<br/> <b>A</b> ppm for salinity units <b>IF</b> values between 5 000 and 40 000</p> <p><b>I</b> PSU for salinity units (PSU values can be used to measure salinity but they have no units)</p> <p>if no other mark awarded:<br/> <b>A</b> °C / K <b>AND</b> ppt / ‰ / g dm<sup>-3</sup> / g per dm<sup>3</sup> <b>for 1 mark</b></p> |
| <i>standardised variable</i>    | <i>suitable value to use</i>                                                                                                                                                                                                                                                                                                              | <i>units</i>                 |                              |              |  |                                 |                       |  |   |          |                        |  |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Antarctic sea water temperature | –2 to 5 <b>AND</b> °C                                                                                                                                                                                                                                                                                                                     |                              | ;                            |              |  |                                 |                       |  |   |          |                        |  |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| salinity                        | 5 to 40 <b>AND</b> ppt                                                                                                                                                                                                                                                                                                                    |                              | ;                            |              |  |                                 |                       |  |   |          |                        |  |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(d)     | <p><i>(supports)</i></p> <p><b>1</b> increase in chlorophyll increases photosynthesis / <b>ORA</b> ;</p> <p><b>2</b> <i>idea that</i> (primary) productivity is linked to the rate of photosynthesis <b>OR</b> productivity is the rate of production of biomass per unit, area / volume ;</p> <p><b>3</b> <i>idea that</i> iron (ions) may help production of chlorophyll ;</p> <p><b>MAX 3 from:</b><br/> <i>(does not support)</i></p> <p><b>4</b> chlorophyll does not contain iron / chlorophyll contains magnesium ;</p> <p><b>5</b> no evidence of link between magnesium concentration and icebergs ;</p> <p><b>6</b> no data provided to support statements ;</p> <p><b>7</b> correlation does not always mean causation ;</p> <p><b>8</b> <b>AVP</b> ;</p> | <b>4</b> | <p><b>A</b> less chlorophyll reduces photosynthesis</p> <p><b>A</b> ref to used by enzymes that produce chlorophyll</p> <p><b>A</b> not used to make chlorophyll</p> <p><b>A</b> other factors may affect, productivity / photosynthesis / chlorophyll production<br/> e.g. very large icebergs would block light to producers below (so reduce productivity)</p> |

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| Question | Answer                                                                                                                                      | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| 2(a)(i)  | <p>clear continuous outline with thin lines with no shading and no gaps ;</p> <p>suitable size ;</p> <p>in proportion ;</p> <p>detail ;</p> | <b>4</b> | <p>I any diagram that does not relate to the photo</p> <p><b>MAX 3 if clearly drawn in pen (R MP1)</b></p> <p>A gaps where the photo is cropped</p> <p>at least as large as the image</p> <p>large blade approx. 3× longer than air bladders,</p> <p>4–5 air bladders <b>AND</b> some 'bristles' (accept lines for the bristles, but they must mostly stop at the edge of and touch the blade) on both sides of large blade</p> <p><b>AND</b> at least one blade overlapping another</p> |

| Question | Answer                                                                                                                                                                                  | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| 2(a)(ii) | <p>stipe <b>AND</b> one blade <b>AND</b> air bladder <b>AND</b> each with correct label line ; ;</p>  | 2     | <p><b>A</b> labels on photo but labels on diagram take precedence</p> <p>correctly labelled means a straight line <b>AND</b> touching the correct structure</p> <p><b>A for 1 mark:</b><br/>two structures with correct label lines<br/><b>OR</b><br/>three clearly identified correct structures with poor lines (not straight and / or not touching but unambiguously identifying all three structures correctly)</p> <p><b>A</b> gas bladder for air bladder</p> <p><b>R</b> arrows (max 1 if all structures clearly identified correctly)<br/><b>I</b> more than 1 blade labelled if correct<br/><b>R</b> any incorrect additional labels<br/><b>I</b> any correct additional labels<br/><b>ECF</b> allow correct labels on their own different diagram</p> |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2(b)(i)  | <p><i>any 2 from:</i><br/> <i>idea that method affects, likelihood / attraction / ability to catch, different species ;</i></p> <p><i>idea that different species of fish, swim / live, at different depths / different parts, of kelp forest ;</i></p> <p>reference to benthic or pelagic ;</p> <p><i>idea that different size of fish will be caught ;</i></p> <p><i>idea that bait used would affect results (stomach contents) ;</i></p> | <b>2</b> | <p><b>I</b> more accurate / validity<br/> <b>I</b> bias unqualified</p> <p>e.g. (more capture methods give) more representative / more reliable, sample / data<br/> <b>A</b> different baits attract different fish</p> <p><b>A</b> suitable descriptions e.g. <i>on sea floor or different behaviours such as differences in, swimming speed / mobility</i> <b>BOD</b></p> |
| 2(b)(ii) | (stomach contents show) what the (fishes) eat / feeding relationships / predator-prey relationships ;                                                                                                                                                                                                                                                                                                                                        | <b>1</b> | <p><b>I</b> ref to trophic level without making clear that the fish are consuming other organisms<br/> <b>A</b> <i>idea of</i> shows what fish, prey on / hunt</p>                                                                                                                                                                                                          |

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| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| 2(b)(iii) | <p><i>any 2 from:</i></p> <p><i>idea that</i> food availability might change / only shows recent food eaten ;</p> <p>(higher or apex) predators may not be included / organisms at different trophic levels might not be represented / ref. to other (non-fish) species in food web / no decomposers / detritivores ;</p> <p>not all fish species have been caught ;</p> <p>not all stomach contents will be identifiable ;</p> <p>stomach might be empty ;</p> | <b>2</b> | <p>I ref to bioaccumulation</p> <p><b>A</b> named organisms or groups such as i invertebrates / urchins etc.<br/> <i>e.g. Some species of fish may not have consumed a certain prey species (it uses as food) at the time of the research</i></p> <p><b>A</b> seasonal changes or time of day changes</p> <p><b>A</b> ref. to birds / other organisms living out of the water</p> <p><b>A</b> small sample size</p> <p><b>A</b> <i>idea of</i>, partly / fully, digested / dissolved / fragments too small / microscopic / producers difficult to identify</p> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                          | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| 2(b)(iv) | <p>correct labels on both axes ;</p> <p>suitable linear scale on y-axis <b>AND</b> bars spread over at least half of grid on x-axis ;</p> <p>all five bars drawn to correct heights <math>\pm 1</math> mm ;</p> <p>all bars equal width <b>AND</b> equal width gaps between bars <b>AND</b> drawn in pencil ;</p>                                                               | <b>4</b> | <p><b>I</b> any shading etc.</p> <p>(fish) species <b>AND</b> total number caught</p> <p><b>A</b> axes either way</p> <p>scale must allow bars to cover more than half grid in both directions, y-axis must go to at least 70 must be at least 2 correct scale values</p> <p>if top of bar(s) not level allow if variation stays within 1 mm of correct height</p> <p><b>A</b> correctly plotted bars (confirmed with overlay) without scale on y-axis</p> <p><b>R</b> single line as bars, bars must be at least 2 mm (1 small square) wide</p> <p><b>A</b> different size gap between y-axis and first bar</p> <p>equal width <math>\pm 1</math> mm</p> <p><b>R MP4</b> for line graph.<br/><b>MP1–3</b> can still be awarded for a line graph</p> |
| 2(c)(i)  | <p><i>species: E ;</i></p> <p><i>explanation: idea that it is the <u>only</u> species that feeds on other fish ;</i></p> <p><b>AND any 1 from:</b></p> <p>other fish made up the majority of their diet / greatest proportion or mass of their diet ;</p> <p>the small invertebrates (in stomach of species E) might have been in the stomachs of fish eaten by species E ;</p> | <b>3</b> | <p>If <b>E</b> incorrect then no marks for explanation if no answer for species then please check explanation</p> <p><b>A</b> only organism that ate every other organism (listed)</p> <p><b>A</b> it (is the only fish that) eats everything <b>BOD</b></p> <p><b>I</b> comparison in terms of invertebrates / non-fish species eaten</p>                                                                                                                                                                                                                                                                                                                                                                                                           |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| 2(c)(ii) | <p><i>any 1 advantage from:</i><br/> can observe other animals feeding (apart from fish) ;</p> <p>easier to identify what is being eaten ;</p> <p>video footage can be, reviewed / rewatched ;</p> <p><i>idea that</i> fish not, killed / dissected / altering population ;</p> <p><i>any 1 disadvantage from:</i><br/> may not see all feeding relationships (of the fish) ;</p> <p><b>AVP ;</b></p> | <b>2</b> | <p><b>A</b> footage of feeding</p> <p><b>I</b> can be viewed / watched, MP is for idea of being about to go back and check</p> <p><b>A</b> more ethical<br/> <b>I</b> fish not harmed</p> <p><b>I</b> ref. to poor quality / blurred images etc.<br/> <b>I</b> disturb / disrupt / scare, fish / ecosystem but allow if used to explain disruption to feeding<br/> <b>A</b> ref. to not seeing microscopic organisms<br/> <b>A</b> ref. to not feeding at times observed</p> <p>limitations of diving e.g. man-hours / time, cost, time under water, risk,</p> |

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| Question | Answer                                                                                                                                                                                                                                                                                                                           | Marks | Guidance                                                                                                                                                                                                                                                                        |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3(a)     | <i>benthic</i> : the bottom (layer), of the ocean / water<br><b>OR</b><br>(sea) floor dwelling<br><b>OR</b><br>in / on, the, sediment / substrate / sea floor / ocean floor ;<br><br><i>sessile</i> : <i>idea that</i> the organism can not relocate itself<br><i>e.g. fixed in one place OR attached to, rock / substrate ;</i> | 2     | <b>A</b> lowest part of the ocean for bottom of ocean<br>I ref. to light<br><br>I ref. to structural (needs to be fixed in place)<br>I can't move / immobile / stuck                                                                                                            |
| 3(b)(i)  | (salinity) increases <b>AND</b> decreases ;<br><br>high(er) salinity is at high tide <b>OR</b> low(er) salinity is at low tide ;                                                                                                                                                                                                 | 2     | <b>R</b> decreases followed by increases<br>I stated values<br><b>A</b> description of change with values                                                                                                                                                                       |
| 3(b)(ii) | as tide rises more sea water enters <b>OR</b> as tide falls less sea water enters ;<br><br><i>idea that</i> more sea water increases the salinity in the, estuary / bay / <b>ORA</b> ;<br><br>salinity increases as <u>proportion</u> of sea water to fresh water increases / <b>ORA</b> ;                                       | 3     | I ref to changes in river water entering bay<br><b>A</b> more sea water at high tide than at low tide<br><b>A</b> ref to in bay or in estuary<br><br><b>A</b> fresh / river water dilutes the salinity of the sea water<br><b>A</b> ref to brackish water in the, bay / estuary |

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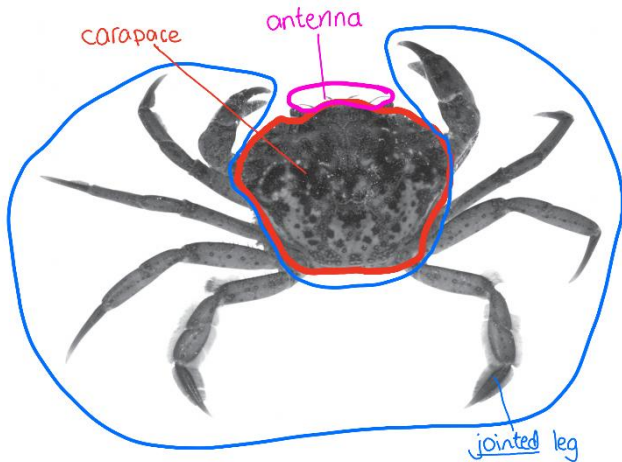
| Question  | Answer                                                                                                                                | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-----------|-----------------|---|--|----|--|----|--|----|--|----|--|
| 3(c)(i)   | <p>heading for depth in m <b>AND</b> species ;</p> <p>table with rows and columns <b>AND</b> states depths of 5, 10, 15, 20, 25 ;</p> | 2     | <p><b>I</b> graphs</p> <p>must be within table, minimum to accept it within top part of a 't', e.g.</p> <table><tr><td>depth / m</td><td>species</td></tr></table> <p><b>A</b> 'number of species' for 'species'</p> <p><b>R MP1</b> if 'm' written by separate depths in body of table</p> <p><b>I</b> additional headings unless incorrect</p> <p>must be separate spaces for each depth e.g.</p> <table><tr><td>depth / m</td><td>species present</td></tr><tr><td>5</td><td></td></tr><tr><td>10</td><td></td></tr><tr><td>15</td><td></td></tr><tr><td>20</td><td></td></tr><tr><td>25</td><td></td></tr></table> <p><b>I</b> repeats at each depth</p> | depth / m | species | depth / m | species present | 5 |  | 10 |  | 15 |  | 20 |  | 25 |  |
| depth / m | species                                                                                                                               |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
| depth / m | species present                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
| 5         |                                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
| 10        |                                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
| 15        |                                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
| 20        |                                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |
| 25        |                                                                                                                                       |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |         |           |                 |   |  |    |  |    |  |    |  |    |  |

| Question | Answer                                                                                                                                                                                                                                                                                                          | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3(c)(ii) | <p><i>same depth: idea of</i> sample a larger area / make sure the results are representative ;</p> <p><i>different depths: idea of</i> to investigate the effect of depth on / compare the depths on / observe changes in, (species present) ;</p>                                                             | 2     | <p><b>A</b> to get, more / multiple, results<br/> <b>A</b> make <u>more</u> reliable / <u>improve</u> reliability / <u>improve</u> validity<br/> <b>A</b> idea of check (results) are similar / consistent / identify anomalies / ignore anomalies / identify outliers / ignore outliers<br/> <b>I</b> ref to not get, anomalies / outliers<br/> <b>I</b> to calculate a mean<br/> <b>I</b> more accurate</p> <p><b>A</b> sample more of the ecosystem<br/> <b>A</b> organisms for species<br/> <b>A</b> a descriptions of comparisons <i>e.g. some depths may have more species than other depths</i></p>                                                              |
| 3(d)(i)  | <p><i>any 3 from:</i><br/> <i>idea of</i> greatest abundance at 5 m ;</p> <p>none present at 10 m / very little present from 10–15 m ;</p> <p><i>idea of</i> from, 10 / 15 m, to 25 m increases in abundance ;</p> <p>use of <u>manipulated data</u> to support answer + referring to increase / decrease ;</p> | 3     | <p><b>I</b> vague references to depth e.g. lower or higher depth</p> <p><b>A ECF</b> if answers match the data for white boxes described in the marking points but candidate has misunderstood &gt; to be less than, and written answers in terms of structures less than 8 cm (<b>R MP1</b>)</p> <p><b>R</b> none present at 15 m</p> <p><b>A</b> decreases then increases</p> <p><b>must be comparative</b> <i>e.g. greater, more than, decrease, etc.</i><br/> <b>A</b> use of 0 at 10 m, e.g. decreases <u>by</u> 13 (%) from 5 to 10 m.<br/> <b>A</b> differences in data (i.e. subtractions)<br/> <b>I</b> quoting data (<i>e.g. decreases from 23 to 22</i>)</p> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                             | Marks                   | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |        |        |  |      |                        |                        |   |       |                         |                         |   |       |                         |                        |   |       |                        |                  |   |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|--------|--|------|------------------------|------------------------|---|-------|-------------------------|-------------------------|---|-------|-------------------------|------------------------|---|-------|------------------------|------------------|---|
| 3(d)(ii) | <p><i>any 4 from:</i></p> <p><b>1</b> both increase <b>AND</b> decrease ;</p> <p><b>2</b> peak / maximums, at different depths ;</p> <p><b>3</b> 0–2 cm found at all depths / has a greater distribution <b>OR</b> no 5–8 cm, at 25 m / at deeper depths than 20 m ;</p> <p><b>4</b> 0–2 cm was more abundant at all depths compared to 5–8 cm ;</p> <p><b>5</b> use of manipulated data to support answer ; ;</p> | <b>4</b>                | <p><b>I</b> thrives / skyrockets</p> <p><b>I</b> (initial / 5–10 m) small decrease in 0–2 and small increase from 20–25 m)</p> <p><b>A</b> 5–8 cm peaks at 10 m <b>AND</b> 0–2 cm peaks at 15 m</p> <p><b>I</b> 0–2 cm similar / consistent, at all depths</p> <p>Examples of data manipulation</p> <table border="1"> <thead> <tr> <th>Depth</th><th>0-2 cm</th><th>5-8 cm</th><th></th></tr> </thead> <tbody> <tr> <td>5-10</td><td>small decrease (by 2%)</td><td>Large Increase (by 9%)</td><td>;</td></tr> <tr> <td>10-15</td><td>Large increase (by 19%)</td><td>Large decrease (by 13%)</td><td>;</td></tr> <tr> <td>15-20</td><td>Large decrease (by 11%)</td><td>Small decrease (by 3%)</td><td>;</td></tr> <tr> <td>20-25</td><td>Small increase (by 1%)</td><td>decrease (by 5%)</td><td>;</td></tr> </tbody> </table> <p><b>NOTE</b> need a <b>PAIR</b> of data for each data mark</p> <p><b>A</b> 0–2 m has a mean of 31.6 (for 5–25 m) <b>AND</b> 5–8 m has a mean of 9.2 (for 5–20 m)</p> | Depth | 0-2 cm | 5-8 cm |  | 5-10 | small decrease (by 2%) | Large Increase (by 9%) | ; | 10-15 | Large increase (by 19%) | Large decrease (by 13%) | ; | 15-20 | Large decrease (by 11%) | Small decrease (by 3%) | ; | 20-25 | Small increase (by 1%) | decrease (by 5%) | ; |
| Depth    | 0-2 cm                                                                                                                                                                                                                                                                                                                                                                                                             | 5-8 cm                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |        |        |  |      |                        |                        |   |       |                         |                         |   |       |                         |                        |   |       |                        |                  |   |
| 5-10     | small decrease (by 2%)                                                                                                                                                                                                                                                                                                                                                                                             | Large Increase (by 9%)  | ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |  |      |                        |                        |   |       |                         |                         |   |       |                         |                        |   |       |                        |                  |   |
| 10-15    | Large increase (by 19%)                                                                                                                                                                                                                                                                                                                                                                                            | Large decrease (by 13%) | ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |  |      |                        |                        |   |       |                         |                         |   |       |                         |                        |   |       |                        |                  |   |
| 15-20    | Large decrease (by 11%)                                                                                                                                                                                                                                                                                                                                                                                            | Small decrease (by 3%)  | ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |  |      |                        |                        |   |       |                         |                         |   |       |                         |                        |   |       |                        |                  |   |
| 20-25    | Small increase (by 1%)                                                                                                                                                                                                                                                                                                                                                                                             | decrease (by 5%)        | ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |  |      |                        |                        |   |       |                         |                         |   |       |                         |                        |   |       |                        |                  |   |

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| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Marks | Guidance                                                                                                                                                                                                                                                                                                                    |
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| 3(d)(iii) | <p><u>1</u> most / greatest, light <b>OR</b> highest temperatures ;</p> <p><b>PLUS any 2 from:</b></p> <p><u>2</u> (0–5 m) greatest abundance of tallest living structures ;</p> <p><u>3</u> (0–5 m) provides most space for other organisms to live in ;</p> <p><u>4</u> (0–5 m) <i>idea that this</i> contains all 4 heights in most even distribution ;</p> <p><u>5</u> (0–5 m) has the greatest productivity ;</p> <p><u>6</u> (0–5 m) will have highest (dissolved) oxygen (concentration) ;</p> <p><u>7</u> (0–5 m) has the most niches ;</p> | 3     | <p>I ref to minerals / nutrients (e.g. from run off)</p> <p>I more / high, must imply 'most' of any of the depths</p> <p><b>A</b> most consistent distribution of heights</p> <p><b>A</b> highest rate of photosynthesis</p> <p><b>A</b> most producers</p> <p><b>A</b> most oxygen</p> <p><b>A</b> most places to hide</p> |

| Question | Answer                                                                                                                                                                                                                                                        | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4(a)(i)  | <p>any 2 from:<br/> <u>carapace</u> accurately labelled ;</p> <p>one <u>jointed leg / appendage</u>, accurately labelled ;</p> <p><u>antenna</u> accurately labelled ;</p>  | 2     | <p>I attempt to label segmented abdomen<br/> I compound eyes</p> <p><b>MAX</b> 1 mark for <b>two correct unambiguous labels</b> with arrow heads <b>OR</b> not reasonably straight line label <b>OR</b> line(s) not touching feature</p> <p><b>A</b> cephalothorax<br/> I exoskeleton<br/> I shell<br/> I thorax</p> <p><b>A</b> segmented for jointed<br/> <b>A</b> limb for leg<br/> I walking, legs / appendages<br/> I claw / chela / swimmerets</p> <p>I additional non-general information on labels e.g. 'spotted carapace'</p> |

| Question | Answer                                                                                                                                                                                  | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4(a)(ii) | <p>use of <u>paired</u> (comparative) statements ;</p> <p><i>plus any 1 from:</i></p> <p>(easily) <u>visibly identifiable</u> features ;</p> <p>suitable example <u>for crabs</u> ;</p> | 2     | <p><b>A</b> true or false statements<br/> <b>I</b> mutually exclusive statements unless stated as a <u>pair of</u> mutually exclusive statements<br/> e.g. a stated example of a pair of statements (this would give <b>MP1</b> and <b>MP3</b> if features are appropriate)</p> <p><b>A</b> <u>visible</u> feature found on one organism but not on another for 2 marks</p> <p><b>A</b> observable / visible / external, features<br/> <b>I</b> ref. to key / physical, (features)</p> <p>e.g. relative size of claws / legs / carapace, shape of carapace (<b>A</b> shell), colour, etc.<br/> <b>A</b> (stated) shape / colour / markings</p> <p><b>I</b> number of legs or antenna<br/> <b>I</b> size (where this would vary due to age – allow if referring to size of one feature in proportion to another feature)<br/> <b>A</b> presence of swimming legs</p> <p>example of a single statement for an appropriate feature give <b>MP2</b> only</p> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                        | Marks    | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4(b)(i)  | <p><i>any 4 from:</i></p> <p><b>1</b> catch (the crabs) <b>AND</b> <u>count</u> / stated number caught ;</p> <p><b>2</b> tag / mark (all crabs) <b>AND</b> release ;</p> <p><b>3</b> return (stated time, same place) later <b>AND</b> catch a second sample (of the crabs) ;</p> <p><b>4</b> count the number of crabs tagged <b>AND</b> the total caught the second time ;</p> <p><b>5</b> <b>AVP</b> ;</p> | <b>4</b> | <p>if method describes species other than crabs <b>R MP1</b>, then allow <b>ECF max 3 marks</b></p> <p><b>I</b> catch and mark<br/> <b>A</b> collect / sample, for catch<br/> <b>A</b> record for count<br/> <b>I</b> record <u>amount</u> of crabs</p> <p><b>A</b> 'capture – mark – release' = MP2<br/> <b>A</b> 'mark – release – recapture' = MP2</p> <p><b>A</b> any reasonable stated time frame e.g. a day, week, month<br/> <b>A</b> 'suitable' time<br/> <b>A</b> idea of allow to mix / reintegrate then catch second sample</p> <p><b>A</b> count marked and unmarked crabs</p> <p>e.g. mark / tag, in a way that doesn't affect survival (or stated example e.g. non toxic paint, etc)</p> <p>use same capture technique / same time of day / same duration of counting crabs</p> <p><b>I</b> <math>N = \frac{n_1 \times n_2}{m_2}</math> but if equation in words includes count crabs caught before (<b>MP1</b>) and count tagged and untagged crabs after (<b>MP4</b>) these marks can be awarded</p> <p><b>I</b> any ref to quadrat / transect etc</p> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4(b)(ii) | <p><i>any 2 from:</i></p> <p><i>idea of</i> moulting / shedding, exoskeleton ;</p> <p><i>idea of</i> (it is difficult to account for) births, and / or, deaths ;</p> <p><i>idea of</i> migration (in to or out from the area) ;</p> <p><i>idea that</i> crabs could be hidden <b>AND</b> so not, caught / counted / marked ;</p> <p><i>idea that</i> first sample may not have fully mixed with rest of population ;</p> | 2     | <p>I ref to human error / miscount</p> <p>I idea of mark coming off <i>e.g. tag falls off, mark wearing off, etc.</i></p> <p>A predated / eaten / fished</p> <p>I tagging harms organism</p> <p>A tag / paint, may have caused them to get eaten</p> <p>A immigration / emigration</p> <p>I moved / relocated</p> <p>A move, in to / out of, the area</p> <p><i>e.g. in rocks / buried / etc.</i></p> <p>A ref to even distribution</p> |
| 4(c)     | <p>decreases <b>AND</b> increases <b>AND</b> lowest / minimum, in 2023 ;</p> <p><i>and any one from:</i></p> <p><i>idea of</i> quite small variation in population / the variation in the numbers is relatively small in relation to the total ;</p> <p>data manipulation <b>OR</b> only about a 10% change ;</p>                                                                                                        | 2     | <p>A decreases to 2023 then increases</p> <p>A decreases <b>AND</b> increases from 2024</p> <p><i>e.g. calculated difference from one year to another (e.g. increase by 27 from 2023 to 2024) or across the 5 years.</i></p> <p><i>e.g. increased (overall / from 2021 to 2025) by 21 / 4(.3)%</i></p>                                                                                                                                  |

**PUBLISHED****Appendix – additional guidance for marking responses from candidates who have used braille papers**

The table below lists modifications made on the braille paper only where a different approach to marking is required.

| Question  | Modification                                                                                                            | Marks | Marking guidance                                                                                                                                                                                                  |
|-----------|-------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1(c)(iii) | No table. Candidates asked to give suitable values and units for sea water temperature and salinity next to A, B, C, D. | 2     | sea water temperature<br>suitable value: <b>A</b> -2 to 5<br>units: <b>B</b> °C<br><br>salinity:<br>suitable value: <b>C</b> 5 to 40<br>units: <b>D</b> ppt<br>;;<br>use standard marking guidance alongside this |
| 2(a)(i)   | No space for drawing. Candidates asked to assess criteria for a good biological drawing.                                | 4     | <i>any 4 from:</i><br>outline: unbroken lines ;<br>no shading ;<br>use pencil ;<br>in proportion ;<br>size: big enough to see some detail ;                                                                       |
| 2(a)(ii)  | Candidates asked to write down the name of structures X, Y and Z using the four options provided.                       | 2     | X – stipe<br>Y – blade<br>Z – air bladder<br>;;<br><br>Use standard marking guidance alongside this                                                                                                               |

| Question | Modification                                                                                                                                                                    | Marks | Marking guidance                                                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2(b)(iv) | Values in table changed to:<br>A 20<br>B 30<br>C 5<br>D 55<br>E 10<br>Scale given to candidates.<br>Candidates asked to label both axes<br>Candidates asked to draw a bar chart | 4     | correct labels on both axes ;<br>blots marked to correct heights ;;;<br><br>use professional judgement to give leeway for plotting 'bars'. Blots may just be marked to correct heights without vertical lines being drawn. |
| 3(c)(i)  | Candidates asked to describe the table rather than draw                                                                                                                         | 2     | use standard mark scheme                                                                                                                                                                                                   |
| 3(d)(i)  | Small squares removed from Figure 3.2 graph                                                                                                                                     | 3     | use standard mark scheme but for using manipulated data in MP4, leeway may be needed                                                                                                                                       |
| 3(d)(ii) | Small squares removed from Figure 3.2 graph                                                                                                                                     | 4     | use standard mark scheme but for using manipulated data in MP4 and 5, leeway may be needed                                                                                                                                 |
| 4(a)(i)  | Changed picture to a line drawing with texture with labels A and B added that need to be identified.                                                                            | 2     | A – jointed leg ;<br>B – carapace ;                                                                                                                                                                                        |