



## Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/33**

Paper 3 A Level Theory

**May/June 2023**

MARK SCHEME

Maximum Mark: 75

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

**PUBLISHED****Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

**Science-Specific Marking Principles**

|   |  |
|---|--|
| 1 | Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.  |
| 2 | The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.  |
| 3 | Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).  |
| 4 | The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.   |
| 5 | <p><u>'List rule' guidance</u></p> <p>For questions that require <i>n</i> 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 <i>n</i>.</li><li>• Incorrect responses should not be awarded credit but will still count towards <i>n</i>.</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 <i>n</i> 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.

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- This mark scheme will use the following abbreviations:

|                         |   |
|-------------------------|---|
| ;                       | separates marking points  |
| /                       | separates alternatives within a marking point   |
| ()                      | 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>MAX</b>              | indicates the maximum number of marks that can be awarded   |
| <b>+</b>                | statements on both sides of the + 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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| <b>Question</b> | <b>Answer</b>   | <b>Marks</b> |
|-----------------|---|--------------|
| 1(a)            | cnidaria ;  | <b>1</b>     |
| 1(b)            | <p><i>any 3 of:</i><br/> <u>overfishing</u> of anchoveta / tuna ;</p> <p>fewer anchoveta means, less competition for zooplankton ;<br/> more zooplankton for jellyfish, (so numbers increase) ;<br/> (fewer) turtles, as caught (in fishing nets) as by-catch ;<br/> fewer, tuna / turtles, results in less predation, (so numbers increase) ;</p>  | <b>3</b>     |
| 1(c)            | <p><i>fishing industry</i> – idea of fill up nets, so reducing fish catch ;</p> <p><i>desalination plants</i> – block water inlet / outlet pipes, (so stopping desalination process) ;</p>  | <b>2</b>     |
| 1(d)(i)         | <p><i>any 3 of:</i><br/> oil breakdown, increases / is faster, when mucus is added ;<br/> as nitrogen is limiting (in sea water) ;<br/> (jellyfish) mucus provides bacteria with (extra) nitrogen ;<br/> nitrogen used to make, DNA / RNA / amino acids / proteins (for growth) ;<br/> <u>increased reproduction / numbers</u> of bacteria ;<br/> correct <u>manipulation</u> of data ;</p> | <b>3</b>     |
| 1(d)(ii)        | <p>idea of mucus from jellyfish traps plastic microbeads ;<br/> could be used in water treatment / <u>before</u> release into oceans / increased bacterial numbers to break down plastic ;</p>  | <b>2</b>     |

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| <b>Question</b> | <b>Answer</b>   | <b>Marks</b> |
|-----------------|---|--------------|
| 2(a)            | <p><i>any 2 of:</i><br/>           water flow (in river / at river mouth) slows / decreases ;<br/> <u>silt / sediment</u> deposited / sedimentation occurs ;<br/>           little wave action, so little erosion ;<br/>           river (branches and) becomes shallower / wider ;</p>   | <b>2</b>     |
| 2(b)(i)         | to kill any, parasites / remaining marine species present ;   | <b>1</b>     |
| 2(b)(ii)        | <p><i>any 2 of:</i><br/>           (source of) calcium for exoskeleton of shrimp ;<br/>           required after each moult ;<br/>           removed by harvesting shrimp ;</p>   | <b>2</b>     |
| 2(b)(iii)       | <p><i>any 2 of:</i><br/>           over-harvesting of wild (juvenile) shrimp / not enough wild (juvenile) shrimp to meet demand ;<br/>           other marine organisms compete for food in the pond ;<br/>           less food available for shrimp <u>growth</u> ;<br/>           (idea of) evolutionary pressure / survival of the smallest ;</p>  | <b>2</b>     |
| 2(b)(iv)        | <p><i>any 1 of:</i><br/>           reduced (production) costs + example ;<br/>           low technical skills required ;<br/>           reduced chance of disease (due to low stocking densities) ;</p>   | <b>1</b>     |
| 2(c)            | <p><i>any 4 of:</i><br/>           during winter months ponds will flood with saline water, so (soils in) ponds will be saline ;<br/>           shrimp grow in saline water (in winter) ;<br/>           in summer months increased, river water / fresh water / rain water, can be added to ponds ;<br/>           by opening gates / allowing water to flow through inlet pipe (to fill irrigation channel /ponds with fresh water) ;<br/>           outlet pipe opens (to drainage channel) to remove the salt / to desalinate the ponds ;<br/>           rice grows in less saline water (in summer) / rice cannot tolerate salt water;<br/> <b>AVP</b> ;</p> | <b>4</b>     |



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| <b>Question</b> | <b>Answer</b>   | <b>Marks</b> |
|-----------------|---|--------------|
| 3(a)            | store water, to prevent desiccation / as fresh water is limiting ;  | <b>1</b>     |
| 3(b)            | <i>any 3 of:</i><br>water entered the, plant / inner layer of cells, by <u>osmosis</u> ;<br>from higher water potential (distilled water) to lower water potential (plant) / <u>down</u> a water potential gradient ;<br>outer layer was covered in a waterproof layer ;<br>preventing water <u>entering</u> (by osmosis) ;<br>cells in inner layer expanded more than those on outside ; | <b>3</b>     |
| 3(c)(i)         | <i>x-axis label</i> – sucrose concentration <b>and</b> mol dm <sup>-3</sup> ;<br><br><i>y-axis label</i> – degree <b>or</b> angle of curvature / bending ;<br><br><i>line</i> – (straight) line crosses <i>x-axis</i> from positive to negative ;   | <b>3</b>     |
| 3(c)(ii)        | water potential identified where line crosses <i>x-axis</i> ;   | <b>1</b>     |
| 3(c)(iii)       | straight / not curved / no bending ;  | <b>1</b>     |

| <b>Question</b> | <b>Answer</b>  | <b>Marks</b> |
|-----------------|--|--------------|
| 4(a)(i)         | wavelengths / frequencies ;<br>all (of the different), colours / wavelengths / frequencies ;   | <b>2</b>     |
| 4(a)(ii)        | <i>any 4 of:</i><br>green algae contain chlorophyll ;<br>green algae / chlorophyll, absorbs red <b>and</b> blue light ;<br>red light can only penetrate, shallow water / surface layers ;<br>green algae do not have <u>pigments</u> to absorb, green light / light in middle of spectrum ;<br>so at deeper depths, green algae could only absorb blue light ;<br>higher rate of photosynthesis at surface ; | <b>4</b>     |

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| <b>Question</b> | <b>Answer</b>  | <b>Marks</b> |
|-----------------|--|--------------|
| 4(a)(iii)       | <i>any 2 of:</i><br>rate of oxygen production / photosynthesis in green light would increase ;<br>as red algae contain phycobilins ;<br>which absorb, green light / light in the middle, of the spectrum ;   | <b>2</b>     |
| 4(b)(i)         | <i>absorption spectrum</i> – a graph of the absorbance of different wavelengths of light by photosynthetic pigments ;<br><i>action spectrum</i> – a graph showing the effect of different wavelengths of light on (rate of) photosynthesis / oxygen production ;                       | <b>2</b>     |
| 4(b)(ii)        | <i>any 3 of:</i><br>carotenoids are accessory pigments ;<br>absorb wavelengths of around 500 nm ;<br>can transfer energy to chlorophyll <i>a</i> ;<br>not used directly in photosynthesis (in this macroalga) ;<br>as there is no corresponding increase in rate (of photosynthesis) ; | <b>3</b>     |

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| Question | Answer  | Marks |
|----------|---|-------|
| 5        | <p><i>any 10 of:</i></p> <p>1 can lead to overfishing ;</p> <p>2 can lead to loss of biodiversity / negative impact of food webs ;</p> <p><i>sonar</i></p> <p>3 can find / locate, shoals / schools, of fish ;</p> <p>4 shows depth of fish ;</p> <p>5 more efficient than using, marine animals / birds, to indicate fish presence ;</p> <p>6 idea of fish caught more, quickly / efficiently, (increasing catch) ;</p> <p>7 suitable negative effect on marine mammals ;</p> <p><i>purse-seine fishing</i></p> <p>8 catches pelagic fish ;</p> <p>9 net sizes have increased / can be several hundred metres long ;</p> <p>10 catches whole shoals ;</p> <p>11 catches <u>high levels</u> of, juveniles / by-catch / non-target species ;</p> <p>12 e.g. dolphins / turtles / sharks ;</p> <p><i>benthic trawling</i></p> <p>13 <u>net trawled</u> / dragged across the bottom / sea bed ;</p> <p>14 results in very high, by-catch / non-target species ;</p> <p>15 damages habitat / nursery areas (for marine organisms) ;</p> <p>16 releases sediment / increases turbidity;</p> <p>17 example of a negative effect of sediment on marine organisms ;</p> | 10    |

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| Question | Answer   | Marks    |
|----------|--|----------|
| 6(a)     | <p><i>any 5 of:</i></p> <ol style="list-style-type: none"> <li>1 important for tourism ;</li> <li>2 provides <u>employment</u> opportunities ;</li> <li>3 provides economic benefits ;</li> <li>4 provide a food source ;</li> <li>5 coastal protection / prevent coastal erosion ;</li> <li>6 as they dissipate wave energy ;</li> <li>7 provide safe anchorage for boats ;</li> <li>8 source of medicines ;</li> <li>9 areas of high biodiversity ;</li> <li>10 (producers) act as carbon sinks (so reducing global warming) ;</li> <li>11 produce oxygen for respiration ;</li> </ol>   | <b>5</b> |
| 6(b)     | <p><i>any 7 of:</i></p> <ol style="list-style-type: none"> <li>1 burning / combustion, of fossil fuels, produces / releases, carbon dioxide in the atmosphere ;</li> <li>2 carbon dioxide <u>dissolves</u> / <u>dissolution</u> of carbon dioxide, in sea water ;</li> <li>3 (carbon dioxide) reacts with sea water to form carbonic acid ;</li> <li>4 ref to hydrogen carbonate ions / hydrogen ions ;</li> <li>5 <u>reduces</u> pH ;</li> <li>6 reduces carbonate availability in the sea water ;</li> <li>7 photosynthesis uses carbon dioxide ;</li> <li>8 to make, glucose / carbohydrates / proteins / fats ;</li> <li>9 which are taken up by marine animals when they eat plants ;</li> <li>10 respiration / decomposition (in marine organisms) releases carbon dioxide ;</li> <li>11 weathering of rocks containing carbonate ;</li> <li>12 coral polyp skeleton made from calcium carbonate ;</li> <li>13 which erodes / dissolves in acid conditions ;</li> <li>14 <u>acid conditions</u> increase chance of coral bleaching / prevent uptake of calcium carbonate for skeleton ;</li> </ol> | <b>7</b> |

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| Question | Answer   | Marks |
|----------|--|-------|
| 7        | <p><i>any 8 of:</i></p> <ul style="list-style-type: none"> <li>1 raises awareness of conservation ;</li> <li>2 provides funds for conservation projects ;</li> <li>3 limit tourist numbers / tourist activities at site ;</li> <br/> <li>4 ecotourist <u>accommodation</u> / facilities is environmentally friendly ;</li> <li>5 uses, local / sustainable resources ;</li> <li>6 can benefit local population by providing employment / source of income ;</li> <li>7 uses renewable energy sources / reduced power from fossil fuels ;</li> <li>8 e.g. solar panels / fans / electric vehicles ;</li> <li>9 limited use of fresh water ;</li> <li>10 waste water / sewage, is treated (to avoid pollution) ;</li> <li>11 use environmentally friendly cleaning products ;</li> <li>12 reduced use of, plastics / non-biodegradable products ;</li> <li>13 recycling of waste products e.g. paper / cardboard / wood ;</li> <li>14 causes minimal, damage / impact, to natural environment ;</li> </ul> | 8     |