



## **Cambridge International AS & A Level**

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**MARINE SCIENCE**

**9693/11**

Paper 1 AS Level Theory

**May/June 2022**

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

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This document consists of **14** printed pages.

**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 'List rule' guidance  
For questions that require *n* responses (e.g. State **two** reasons ...):
  - The response should be read as continuous prose, even when numbered answer spaces are provided.
  - Any response marked *ignore* in the mark scheme should not count towards *n*.
  - Incorrect responses should not be awarded credit but will still count towards *n*.
  - Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
  - Non-contradictory responses after the first *n* responses may be ignored even if they include incorrect science.

**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.

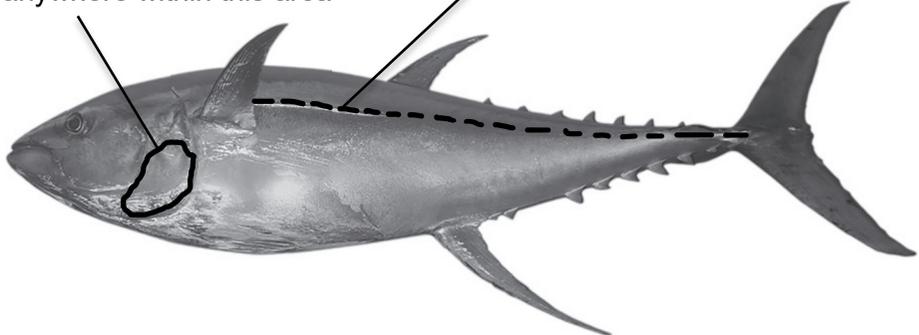
**Key Points**

- Refer to the *Instructions for Examiners (marking scripts on-screen) 2021* booklet for details of all procedures.
- As soon as you are able (usually about two days after the paper set date), please access the question paper and provisional mark scheme from the **RM support portal**. In conjunction with the provisional mark scheme, browse scripts in **RM Assessor (scoris)** and feed any issues or comments to your **Team Leader**.
- The decisions of the **Principal Examiner** are final, and the final agreed mark scheme must be applied as intended by the Principal Examiner. If you are in any doubt about applying this mark scheme, consult your **Team Leader** by telephone or by email.
- Please report any serious problems during marking to your **Team Leader / Principal Examiner** (details in the confidential package).
- If you require technical support, please contact the **RM Helpdesk**. If you require administrative support relating to the examination process, please contact the **CIE Examiner Helpdesk**. For all queries relating to payment, please contact **Cambridge Assessment Finance Division**. Up-to-date contact details for each of these can be found in the *Instructions for Examiners (marking scripts on-screen) 2021* booklet.
- The schedule of dates is very important. It is **essential** that you meet the **Batch 1** and **Batch 2** deadlines. If you experience problems, you must contact your Team Leader without delay.
- Mark strictly to the mark scheme. All marks awarded must relate directly to the mark scheme. However, always credit correct, relevant, science, even if it lies outside of the syllabus content. For answers not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.
- Never transfer marks allocated for one question item to another.
- Where work has been crossed out, mark it when nothing else has been written.
- Do not penalise grammatical constructions/spelling of words that are not in the syllabus, so long as the meaning is clear.
- Credit should be given to all the candidate's correct responses, wherever they have been written (including blank pages, around diagrams, etc.).
- Additional materials may be attached and must be checked for candidates' responses. Show that you have checked blank pages for answers by placing an annotation on each blank page. Do not use crosses or ticks for this purpose, unless the points are credited as part of a response to a specific question. In this instance, please use the On Page Comment tool to clearly annotate which question part the marks relate to.
- If the candidate has left an answer blank, or has left a mark/comment that does not in any way relate to the question (for example 'my dog is black' or '----' or 'can't do' or '?') use the **NR** (No Response, #) option.
- Award 0 marks for any attempt which does not earn credit. This includes copying out all / part of the question or any working that does not earn any marks (whether crossed out or not).

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- This mark scheme will use the following abbreviations:
    - ;  
/
    - ( )
    - R
    - A
    - I
    - AW
    - AVP
    - ORA
    - underline
    - MAX
    - +
    - OR
    - ECF
- 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
- reject
- accept (answers that are correctly cued by the question or guidance you have received)
- ignore (mark as if this material was not present)
- alternative wording (where responses vary more than usual, accept other ways of expressing the same idea)
- alternative valid point (where a greater than usual variety of responses is expected)
- or reverse argument
- actual word underlined must be used by the candidate (grammatical variants excepted)
- indicates the maximum number of marks that can be awarded
- statements on both sides of the + are needed for that mark
- separates two different routes to a mark point and only one should be awarded
- error carried forward (credit an operation from a previous incorrect response)

Question	Answer			Marks															
1	<table border="1"> <thead> <tr> <th data-bbox="629 213 1155 316">environmental factor</th> <th data-bbox="1155 213 1384 316">increases gas solubility</th> <th data-bbox="1384 213 1644 316">decreases gas solubility</th> </tr> </thead> <tbody> <tr> <td data-bbox="629 316 1155 381">decreasing water temperature</td> <td data-bbox="1155 316 1384 381">✓</td> <td data-bbox="1384 316 1644 381"></td> </tr> <tr> <td data-bbox="629 381 1155 446">increasing water depth</td> <td data-bbox="1155 381 1384 446">✓</td> <td data-bbox="1384 381 1644 446"></td> </tr> <tr> <td data-bbox="629 446 1155 512">increasing salinity</td> <td data-bbox="1155 446 1384 512"></td> <td data-bbox="1384 446 1644 512">✓</td> </tr> <tr> <td data-bbox="629 512 1155 577">decreasing atmospheric pressure</td> <td data-bbox="1155 512 1384 577"></td> <td data-bbox="1384 512 1644 577">✓</td> </tr> </tbody> </table>	environmental factor	increases gas solubility	decreases gas solubility	decreasing water temperature	✓		increasing water depth	✓		increasing salinity		✓	decreasing atmospheric pressure		✓			2
environmental factor	increases gas solubility	decreases gas solubility																	
decreasing water temperature	✓																		
increasing water depth	✓																		
increasing salinity		✓																	
decreasing atmospheric pressure		✓																	

Question	Answer	Marks
2(a)(i)	<p>label line touching operculum ;                      label line touching lateral line ;</p> <p>accept operculum line to anywhere within this area</p> <p>accept lateral line label to anywhere shown along this dashed line</p> 	2
2(a)(ii)	<p>any 2 from:                      post-anal tail ;                      notochord ;                      dorsal neural tube ;                      pharyngeal slits ;</p>	2

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(iii)	(primary) consumers ; <b>plus any 1 of:</b> limited mobility / swim weakly ; drift in oceanic currents ;	<b>2</b>
2(b)(i)	thermocline, is shallow(er) / at 15–25 m (accept any stated value within the range) ; <b>plus any 1 from:</b> due to more heat energy OR warm / stable / less varied, conditions ; the dolphins are only found in shallow water / tuna swim in <u>shallower</u> areas ;	<b>2</b>
2(b)(ii)	<b>any 3 from:</b> inaccuracies in identifying individuals second time / assumes no additional scarring has occurred ; photos, may be poor quality / of the other side of the dolphin ; migration / immigration / emigration may have occurred ; dolphins may be, disturbed / stressed, by the presence of boats (and learn to avoid) ; births / deaths may have occurred ; (Lincoln Index) assumes the effort (time taken) for the observations must be the same / <b>AW</b> ; (Lincoln Index) assumes all animals must be equally likely to be seen on the transect ;  (Lincoln Index) assumes equal mixing of all those first observed / <b>AW</b> ;	<b>3</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)(i)	<p><i>any 3 from:</i>            tropical / sub-tropical / within named latitudes (30 degrees north / 30 degrees south) ;            tidal ;            saline ;            freshwater input ;            slow moving water / partly enclosed / low wave action / sheltered / calm waters / shallow ;            sediment run-off from land ;            fine grained sediments / sedimentation ;</p>	<b>3</b>
3(a)(ii)	<p><i>any 4 from:</i>            viviparous ;            seeds remain attached to parent tree ;</p> <p>providing water and nutrients ;            germination occurs (while still attached) ;            forming a propagule ;</p> <p>(propagule) drops into the ocean / water OR floats in the ocean ;            carried by currents ;</p> <p>settles and (continues) growth ;            propagules / plant spread to new areas ;</p> <p>seeds would not survive in sediment around trees / do not compete (for resources) with parent plant ;            (seeds) do not have pneumatophores / cannot survive in anoxic sediment / would die if they absorbed saline water ;</p>	<b>4</b>
3(b)(i)	<p>(Bombekota Bay) loses / decreases / – by, 221 km<sup>2</sup> ;            (coast of Ambanja) gains / increases / + by, 81 km<sup>2</sup> ;</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(b)(ii)	<p><i>any 3 from:</i>            (stated) change in land use (e.g. cleared for shrimp farm / tourism / housing / infrastructure) ;            temperature change (increase / decrease) / climate change / global warming / rising sea level ;            named natural disaster (e.g. hurricanes / cyclones / typhoons / tsunami) / <u>more frequent</u> storms ;            over-harvesting of timber / deforestation ;</p> <p>replanting of mangroves ;            parasites / diseases ;  <b>AVP</b> ;</p>	<b>3</b>
3(c)	<p><i>any 1 from:</i>            (ecological) allows build-up of sediment on coral reefs / sea grass beds ; damages / loses, nursery areas for, fish / marine species / habitat loss ;            (human caused) pollutants increase ;            reduces biodiversity ;            reduces water quality ;  <b>AND</b>            (Impact) reduces, fish stock / income / catch, for fishermen / tourism ;</p> <p><b>OR</b>            reduced protection for shoreline / <b>ORA</b> (mangroves provide protection) ;  <b>AND</b>            increases coastal erosion / increased flooding / damage to (named) infrastructure ;</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)	<i>any 4 from:</i> (erosion is the) removal / movement, of sand particles away from source ; (particles from land) carried by wind or water ; (sand) particles sediment / settle / deposit ; (sedimentation occurs in) areas of low water, velocity / flow / speed ; sedimentation (rate) is higher than erosion (rate) ;	<b>4</b>
4(b)(i)	<i>any 2 from:</i> (stated) economic / tourism ; protection of land ; maintain biodiversity / (turtle / bird) nesting sites / shore bird populations ; provides food (e.g. clams) / nursery area for some fish species ;	<b>2</b>
4(b)(ii)	<i>any 2 from:</i> photosynthesis / photosynthetic / contain chlorophyll / producer ; use light (energy) to convert ; carbon dioxide and water ; to glucose (and oxygen) ; feed (primary) consumers / pass energy along food chain ;	<b>2</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)	<i>any 2 from:</i> sodium chloride / magnesium sulfate / calcium carbonate ;	<b>1</b>
5(b)(i)	<i>any 4 from:</i> covalent ; outer electron shells <u>s</u> not full / (electron sharing) fills outer shells <u>s</u> ; hydrogen requires 1 electron (to fill shell) / has 1 valence electron ; oxygen requires 2 electrons (to fill shell) / has 6 valence electrons ; <u>share</u> electrons ; two hydrogen atoms required for each oxygen atom ;	<b>4</b>

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Question	Answer	Marks
5(b)(ii)	<i>any 3 from:</i> (weak) electrostatic forces (develop) ; oxygen atom becomes (slightly), negatively charged / negative dipole ; hydrogen atom becomes (slightly), positively charged / positive dipole ; positive and negative charges attract ;	<b>3</b>
5(b)(iii)	area for, mammals / birds, to rest on / escape predators ; thermal insulator / <b>ORA</b> / stops the whole water column from freezing ; (substrate for ) ice algae grow on underside ;	<b>2</b>

Question	Answer	Marks
6	<b>MAX 2 from each section:</b> <b>coral polyp and zooxanthellae</b> mutualism ; both organisms benefit ; coral obtains, food / nutrition / energy / carbohydrates / oxygen, from zooxanthellae ; zooxanthellae have, shelter / protection / carbon dioxide, from polyp ;  <b>copepods and marine fish</b> parasitism ; the marine host / fish is harmed ; the parasite / copepod benefits ;  <b>manta rays and remora fish</b> commensalism ; remora fish, benefit / transportation ; the manta rays are neither harmed nor helped ;	<b>6</b>

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Question	Answer	Marks
7(a)	<p><i>any 7 from:</i></p> <ul style="list-style-type: none"> <li>(a) crust / lithosphere broken into plates ;</li> <li>(b) float on magma / mantle / asthenosphere ;</li> <li>(c) movement ;</li> <li>(d) due to convection current ;</li> <li>(e) caused / driven, (by differences in), temperature / density,</li> <li>(f) ongoing / continual / cyclical ;</li> <li>(g) jigsaw fit of continents ;</li> <li>(h) fossil records (at coasts) have same species ;</li> <li>(i) paleomagnetic stripes ;</li> <li>(j) geological matching / correlation (of rock formations) <b>AW</b> ;</li> <li>(k) similar species (alive now) found in different continents</li> <li>(l) <u>named</u> tectonic feature (ocean trench / sea floor spreading / subduction zone / volcanoes / mountain ranges / earthquakes (at plate boundaries) / hydrothermal vents) ;</li> <li>(m) <u>named</u> plate boundary, convergent (destructive) / divergent (constructive) / transform (conservative)</li> </ul>	<b>7</b>
7(b)	<p><i>any 7 from:</i></p> <ul style="list-style-type: none"> <li>(a) warm water of Gulf Stream ;</li> <li>(b) heated at the equator / Caribbean / Gulf of Mexico / equatorial Atlantic ;</li> <li>(c) (warm water) flowing north ;</li> <li>(d) warms atmosphere when it reaches cold (northern) regions / <b>ORA</b>;</li> <li>(e) sea ice formation (in Arctic) leaves sea water saltier ;</li> <li>(f) water cools and sinks ;</li> <li>(g) due to higher density ;</li> <li>(h) pulls more (surface) water (north) ;</li> <li>(i) sinking water moves south ;</li> <li>(j) down to Antarctica ;</li> <li>(k) (Antarctic) circumpolar current around all oceans ;</li> <li>(l) travels into Indian ocean / warmed in the Indian Ocean ;</li> <li>(m) travels back to circumpolar region ;</li> <li>(n) rises as, warmer / less dense, water ;</li> <li>(o) returns to surface due to, mixing / upwelling ;</li> <li>(p) relevant reference to thermohaline <u>current</u> ;</li> </ul>	<b>7</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
8	<p><i>any 10 from:</i></p> <ul style="list-style-type: none"><li>(a) run off ;</li><li>(b) water, from rivers / flowed over land washed in from soil / fertiliser from fields / (weathering or erosion) rocks;</li><li>(c) carries, nutrients / minerals ;</li> <li>(d) upwelling ;</li><li>(e) carries nutrient rich water ;</li><li>(f) from sea bed to the surface ;</li> <li>(g) tectonic activity / hydrothermal vents / underwater volcanoes ;</li><li>(h) release gases / minerals ;</li><li>(i) (gases from vents / volcanoes) dissolve ;</li> <li>(j) atmospheric dissolution / good description of atmospheric dissolution ;</li><li>(k) excretion ;</li><li>(l) decomposition / decay / bacterial action, of dead organisms OR marine snow ;</li><li>(m) <b>AVP</b> ;</li></ul>	<b>10</b>