



## Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/13**

Paper 1 AS 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.

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This document consists of **13** 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 | <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.

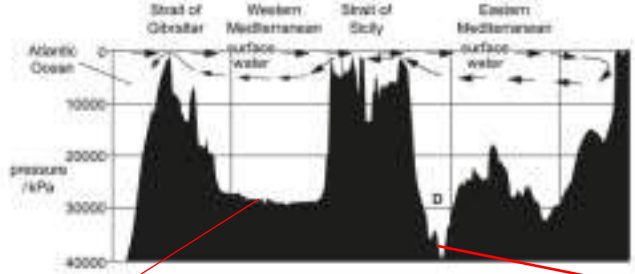
**7** Guidance for chemical equations

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.

- This mark scheme will use the following abbreviations:

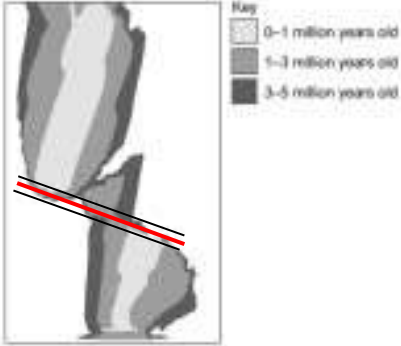
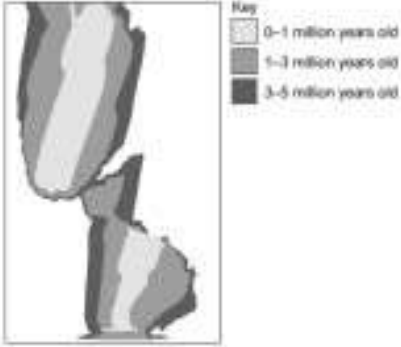
;	separates marking points
/	separates alternatives within a marking point
()	contents of brackets are not required but should be implied / the contents set the context of the answer
R	reject
A	accept (answers that are correctly cued by the question or guidance you have received)
I	ignore (mark as if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


Question	Answer	Marks
1(a)(i)	 <p>abyssal plain</p> <p>trench</p> <p>label lines correctly added ;;</p>	2
1(a)(ii)	<p>mid-ocean ridge / divergent boundary / seafloor spreading ;  magma rises, and solidifies / to create new sea floor ;  sediment settles on it over time ;  explanation of where the sediment comes from ;  uneven surfaces flattening as sediment builds up ;  (idea of) slow process ;</p>	3
1(b)	<u>4000</u> ;	1
1(c)	<p><i>any 4 of:</i>  (only) small amount of mixing from open ocean / Atlantic ;  only small amount of mixing between Western and Eastern Mediterranean ;  evaporation from sea surface increases salinity ;  little freshwater input / ref. to halocline ;  salinity increases with depth due to increased (water) pressure ;  more saline water is more dense / sinks ;</p>	4

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Question	Answer			Marks												
2(a)	<table border="1" data-bbox="342 220 1234 496"> <thead> <tr> <th data-bbox="342 220 719 288">factors</th> <th data-bbox="719 220 945 288">El Niño</th> <th data-bbox="945 220 1234 288">La Niña</th> </tr> </thead> <tbody> <tr> <td data-bbox="342 288 719 357">sea surface temperature in the eastern Pacific</td> <td data-bbox="719 288 945 357">increases</td> <td data-bbox="945 288 1234 357">decreases</td> </tr> <tr> <td data-bbox="342 357 719 426">speed of Easterly winds</td> <td data-bbox="719 357 945 426">decreases</td> <td data-bbox="945 357 1234 426">increases</td> </tr> <tr> <td data-bbox="342 426 719 496">rainfall in the western Pacific</td> <td data-bbox="719 426 945 496">decreases</td> <td data-bbox="945 426 1234 496">increases</td> </tr> </tbody> </table> <p data-bbox="342 496 371 533">⋮</p>			factors	El Niño	La Niña	sea surface temperature in the eastern Pacific	increases	decreases	speed of Easterly winds	decreases	increases	rainfall in the western Pacific	decreases	increases	<b>3</b>
factors	El Niño	La Niña														
sea surface temperature in the eastern Pacific	increases	decreases														
speed of Easterly winds	decreases	increases														
rainfall in the western Pacific	decreases	increases														
2(b)(i)	difference in height between the high tide and (the following) low tide ;			<b>1</b>												
2(b)(ii)	<i>any 2 of:</i> due to, reduced / reversal, of trade winds ; wind no longer blowing offshore / wind blows onshore ; low pressure air system (in eastern Pacific) ;			<b>2</b>												
2(c)(i)	<i>any 3 of:</i> (increased) upwelling ; nutrients (in surface waters) replaced ; increased productivity / producer populations ; increased number of, primary consumers / food for fish ;			<b>3</b>												
2(c)(ii)	tag release recapture / mark release recapture ;			<b>1</b>												



Question	Answer	Marks
3(a)(i)	straight line drawn through the transform fault ; 	1
3(a)(ii)	plates <u>sliding</u> , horizontally / past each other ;	1
3(a)(iii)	(centre of) X marked anywhere within the white / middle area (marked in red) ; 	1
3(a)(iv)	<i>any 3 of:</i> jigsaw fit of continental (coastlines) ; matching of, rock composition / mountains, formations on different continents ; distribution of, same / similar, fossils on different continents ; distribution of very similar living animal species on different continents ; coal deposits in cold regions / Antarctica ; matching glacial deposits on different continents or glacial scarring / striations matching on different continents ; earthquakes / volcanoes / mid oceanic ridges / mountain ranges / seafloor spreading / trenches ;	3

Question	Answer	Marks
3(b)(i)	<p><i>at least 1 of:</i>  hot gas bubbles will quickly decrease in volume once released (as they cool quickly) <b>OR</b> volume increases close to the surface water (as water is warmer near the surface) ;  gas bubbles increase in volume as they move up the water column (due to reduced pressure) ;</p> <p><i>any 3 of:</i>  water is, colder at depth <b>and</b> warmer as it comes to the surface ;  gases released at very high temperature <b>and</b> cool when they meet the (deep) ocean water ;  increased temperature provides more <u>kinetic</u> energy to atoms <b>OR</b> ;  at great depth pressure is higher <b>OR</b> pressure decreases as water becomes shallower ;  when there is less pressure particles can vibrate more (increasing volume) ;</p>	4
3(b)(ii)	<p><i>Either:</i>  (material from volcano) heats water / increases temperature of water ;  decreasing density ;  <b>OR:</b>  <u>dissolved</u> minerals from volcanic activity increases salinity ;  increasing density of the water ;  <b>OR:</b>  increased gases in water ;  reduces density ;</p>	2
3(b)(iii)	 <p>correct sharing of electron pairs shown ;  remaining outer electrons shown ;</p>	2

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)	commensal ; remora fish benefit / named benefit ; manta ray neither helped nor harmed ;	<b>3</b>
4(b)(i)	<i>any 2 of:</i> calcified / ossified skeleton ; operculum ; scales ; visible lateral line ;	<b>2</b>
4(b)(ii)	<i>any 2 of:</i> notochord ; dorsal neural tube ; pharyngeal slits ; post-anal tail ;	<b>2</b>
4(c)(i)	consumers ; limited mobility / drift in water currents ;	<b>2</b>
4(c)(ii)	phytoplankton / algae + zooplankton + manta ray + killer whale in correct order ; arrows in correct direction between each ;	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)	<p><i>any 7 of:</i></p> <ul style="list-style-type: none"> <li>nursery area for juvenile fish ;</li> <li>rich feeding ground for many species ;</li> <li>nesting sites for other species ;</li> <li>fishing ground / increase fishing catch ;</li> <li>traps / stabilises, sediment ;</li> <li>reduces build up (of sediment), on reefs / seagrass beds ;</li> <li>reduces erosion caused by, storms / hurricanes / tsunamis ;</li> <li>brings in tourism or named example, e.g. diving ;</li> <li>harvesting of <u>named</u> food source ;</li> <li>timber / firewood / fuel ;</li> <li>increases biodiversity ;</li> <li>provides natural medicines ;</li> <li>carbon store / sink / climate regulation ;</li> </ul>	<b>7</b>
5(b)	<p><i>any 8 of:</i></p> <ul style="list-style-type: none"> <li><u>prop</u> roots ;</li> <li>for stability ;</li> <li>(in) muddy / sandy, substrate ;</li> <li>so roots uptake oxygen from atmosphere ;</li> <li>oxygen poor, waters / sediment / mud ;</li> <li>salt exclusion (by roots) ;</li> <li>(because) estuarine (brackish) conditions / flooded daily by sea water / saline water ;</li> <li>viviparous reproduction / seeds germinate and remain attached to parent plant / ref. to propagules ;</li> <li>reduces effect of varying salinities on developing seeds ;</li> <li>(propagules) float ;</li> <li>so new plant is ready to start, growing / rooting, as soon as it lands on a suitable substrate / plants can easily take root in new substrate / plant can start growing in a new area (where its species is not currently growing) ;</li> <li>less likely to be eaten ;</li> </ul>	<b>8</b>

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Question	Answer	Marks
6	<p><i>any 9 of:</i>            atmospheric dissolution (to ocean) carbon dioxide ;            dissolves to form carbonic acid ;            uptake by producers ;            in process of photosynthesis / photosynthesis equation ;            turned into organic material or named, e.g. glucose, proteins, carbohydrates, lipids ;            eaten by consumers / passed up the food chain ;            (carbon dioxide) released by <u>respiration</u> / respiration equation ;            dead organisms / faeces, sink to ocean floor ;            decomposition by bacteria ;            upwelling carries carbon dioxide to surface ;            (over millions of years) buried and compacted to form, fossil fuels / fossils ;            (fossil fuels or named) extracted <b>and</b> combusted ;            uptake by corals / other relevant organisms ;            converted into (calcium) carbonates and deposited on reefs / in shells ;            weathering / erosion, of, rocks / reefs, containing carbonates ;            ref. to deposition (of carbonates) to form sedimentary rocks ;</p>	9

Question	Answer	Marks
7	<p>the <u>role</u> of an organism in the community of an ecosystem ;  <i>plus any 5 of:</i>            (organisms limited by) abiotic factors it can tolerate ;            resources available to organisms ;            (coral reef organisms) narrow niches ;            due to high competition ;            correct reference to overlap of niches ;            how competition may be reduced ;            (open ocean) broad niches due to little competition ;            (and) less productivity ;            named coral reef example, (e.g. butterfly fish / parrot fish / zooxanthellae / cleaner fish) OR named open ocean example,            (e.g. shark / tuna / jellyfish) ;</p>	6