



## Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/02**

Paper 2 AS Data-Handling and Free-Response

**October/November 2020**

MARK SCHEME

Maximum Mark: 50

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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.

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This document consists of **10** 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.

- 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)	as a food source (for the periwinkles) / shelter for the periwinkles / to provide oxygen to the water / to absorb carbon dioxide from the water ;	<b>1</b>
1(a)(ii)	<i>any 1 of:</i> same (or very similar e.g. +/- 1 mm) initial length / mass or weight / same shell thickness ; same species of periwinkle ; same sex ;	<b>1</b>
1(a)(iii)	<i>any 1 of:</i> to show anomalous results / <b>AW</b> ; to be able to obtain a mean / average ; improves reliability / consistency / validity of data ;	<b>1</b>
1(a)(iv)	<i>any 2 of:</i> idea of, build-up of waste products ; calcium / food / nutrients depleted, from water for, periwinkle / algae ; no wave action, to aerate the water / it is intertidal species ; lack of oxygen :	<b>2</b>
1(b)(i)	19.05 / 19 (%) ;;	<b>2</b>
1(b)(ii)	(as the crab is a predator) a <u>thicker</u> shell may offer greater protection (to the periwinkle) ;	<b>1</b>
1(b)(iii)	6.8 : 1 OR 1 : 0.15	<b>1</b>
1(b)(iv)	(the organism is using resources to) increase thickness of shell rather than increasing length ;	<b>1</b>

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Question	Answer	Marks
2(a)	appropriate linear <b>scale</b> for y-axis ; both <b>axes</b> labelled including units ; (nitrogen loading / kg per hectare per year and biomass / g per m <sup>2</sup> ) all points <b>plotted</b> correctly (+/-1 mm) ; <b>bars</b> drawn of equal width and separated; <b>key</b> / identification between data sets ;	<b>5</b>
2(b)	<i>any 3 of:</i> 1 <u>supports</u> (as the data) shows a downward trend ; 2 but insufficient data / little data at low levels of nitrogen loading ; 3 unknown sample size ; 4 unknown, number of replicates / if these are means / statistical significance of results ; 5 'macroalgae' (or named species) covers many species, (this effect may not be true for all macroalgae) ; 6 not reproducible ; 7 just because the nitrogen levels are high on one day does not mean that has immediate impact on the seagrass ; 8 unknown timescale this was undertaken over ; 9 <i>Z. marina</i> biomass constant from 300 – 400 ; 10 <b>AVP</b> ;	<b>3</b>
2(c)	<i>any 2 of:</i> (macro) algae grow taller than <i>Z. marina</i> / <i>Z. marina</i> is shorter than macroalgae ; reducing light levels, below / for the <i>Z. marina</i> ; reducing photosynthesis (for <i>Z. marina</i> ) ;	<b>2</b>

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Question	Answer	Marks
3(a)	<p>easterly trade winds / westerly-blowing winds / winds blowing towards Australia / movement of warm moist air (across Pacific), reduce / stop / reverses ;</p> <p><i>plus any 6 from:</i></p> <p>warm water builds up long (west) coast of South America ;  stops upwelling (along S. American coast) ;  no nutrients brought up / to surface (from ocean floor to surface water) ;  reduces productivity / less photosynthesis ;  of phytoplankton / producers ;  less energy passes along the food chain ;  reduction in local fish available / reduced fish catch ;  reduces income / causes starvation ;  increased rainfall along S. American coast line ;  (causes) increased flooding (in S. America coastal areas) ;  thermocline gets deeper ;  global increase in temperature ;  (Asia / Australia) suffers from droughts ;  decreases crop production / named crop production (in Asia / Australia) ;  increases fire risks (in Asia / Australia) ;</p>	<b>7</b>

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Question	Answer	Marks
3(b)	<p><i>max 5 of:</i></p> <ul style="list-style-type: none"> <li>physical damage to coral / pieces breaking off ;</li> <li>sediment abrasion or erosion of coral ;</li> <li>sediment blocking polyp mouths / damage fish gills ;</li> <li>sediment reducing light availability ;</li> <li>for photosynthesis ;</li> <li>by zooxanthellae ;</li> <li>reduced sea temperatures ;</li> <li>reduces coral growth / may cause temporary bleaching ;</li> <li>change in salinity, qualified ;</li> <li>pollution from (named source), qualified;</li> </ul> <p><i>plus max. 5 of:</i></p> <ul style="list-style-type: none"> <li>destruction of coastal buildings / infrastructure / roads / boats ;</li> <li>erosion of shoreline ;</li> <li>flooding of area ;</li> <li>loss of life / disease / famine ;</li> <li>increase input of freshwater (to arid areas) ;</li> <li>nutrient input ;</li> <li>increased / decreased productivity qualified ;</li> <li>increase / decrease in fisheries qualified ;</li> <li>ref. to economic impact, qualified ;</li> <li>decrease in tourism ;</li> </ul> <p><b>AVP ;</b></p>	<b>8</b>



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Question	Answer	Marks
4(a)	<p><i>any 3 of:</i>            (at divergent plate boundaries)            gap between the plates ;            (molten) magma / lava ;            from the mantle ;            rises to fill the space / pushes upwards ;            solidifies in cold water / creates new crust ;            relevant ref. to convection current ;</p> <p><i>plus at least 1 from:</i>            (transform plate boundaries)            no new crust formed ;            no opening or gap between the plates for magma to come out from ;</p>	<b>4</b>
4(b)	<p><i>any 5 of:</i>            idea of, (named mineral input from volcano) increases salinity ;            eruptions release named gases + (any 1 from) carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen chloride ;            (gases) dissolve / mix with atmospheric water / clouds or atmospheric dissolution ;            deposited in the sea with precipitation ;            (same gases) released directly into seawater ;            (which) decreases oxygen levels (in water) ;            localised pH decrease / gases linked to drop in pH / acid rain ;            gases are less soluble in hot water ;            idea of, a lot of volcanic ash would change / increase / decrease, pH ;</p>	<b>5</b>

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Question	Answer	Marks
4(c)	<p><i>max. 4 of:</i></p> <ul style="list-style-type: none"> <li>it is an extreme / harsh environment ;</li> <li>extreme high temperature / stated high temperature (40–400 °C) ;</li> <li>very high pressure/ stated pressure in terms of atmospheres of pressure ;</li> <li>no (sun)light ;</li> <li>low pH / stated pH ;</li> <li>plus at least 2 from:</li> <li>(to survive the extreme conditions)</li> <li>organisms, roles / niches are specialised / are adapted to these conditions;</li> <li>few species / organisms, have these specialisms ORA ;</li> <li>credit named example, e.g. <i>tevnia</i> / <i>riftia</i> / chemosynthetic bacteria / white clams / chemosynthesis occurring ;</li> <li>high biodiversity compared to the rest of the ocean floor ;</li> <li>low biodiversity compared to rocky shore / coral reef ;</li> </ul>	<b>6</b>