



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

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**MARINE SCIENCE**

**9693/12**

Paper 1 AS Level Theory Paper

**October/November 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 October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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This document consists of **12** 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.

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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
  - 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
  - underline 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)

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Question	Answer			Marks												
1(a)	<table border="1"> <thead> <tr> <th data-bbox="439 218 891 320">small molecule</th> <th data-bbox="891 218 1384 320">large molecule</th> <th data-bbox="1384 218 1839 320">main chemical elements in the molecule</th> </tr> </thead> <tbody> <tr> <td data-bbox="439 320 891 451">glucose ;</td> <td data-bbox="891 320 1384 451"></td> <td data-bbox="1384 320 1839 451">carbon / C + hydrogen / H + oxygen / O ;</td> </tr> <tr> <td data-bbox="439 451 891 518">amino acid(s) ;</td> <td data-bbox="891 451 1384 518"></td> <td data-bbox="1384 451 1839 518"></td> </tr> <tr> <td data-bbox="439 518 891 651"></td> <td data-bbox="891 518 1384 651">lipid(s) / fat(s) / triacylglycerol(s) / triglyceride(s) ;</td> <td data-bbox="1384 518 1839 651">carbon / C + hydrogen / H + oxygen / O ;</td> </tr> </tbody> </table>			small molecule	large molecule	main chemical elements in the molecule	glucose ;		carbon / C + hydrogen / H + oxygen / O ;	amino acid(s) ;				lipid(s) / fat(s) / triacylglycerol(s) / triglyceride(s) ;	carbon / C + hydrogen / H + oxygen / O ;	5
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glucose ;		carbon / C + hydrogen / H + oxygen / O ;														
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	lipid(s) / fat(s) / triacylglycerol(s) / triglyceride(s) ;	carbon / C + hydrogen / H + oxygen / O ;														
1(b)(i)	(A) respiration ; (B) feeding / consumption ; (C) (sinking and) decomposition (on the sea bed) ;			3												
1(b)(ii)	drilling / extraction (from ocean / sea floor) ; combustion / burning ; (combustion / burning releases) carbon dioxide ;			3												
1(b)(iii)	<i>any 2 from:</i> pressure / compacted ; from (organic / inorganic) sediments (accumulating above) ; cementation / precipitation (of minerals) ;			2												

Question	Answer		Marks																		
2(a)(i)	<table border="1"> <thead> <tr> <th data-bbox="741 213 983 277">Group</th> <th data-bbox="983 213 1536 277">Leatherback turtle classification</th> </tr> </thead> <tbody> <tr> <td data-bbox="741 277 983 341">domain</td> <td data-bbox="983 277 1536 341">eukaryote / eukaryota / eukarya ;</td> </tr> <tr> <td data-bbox="741 341 983 405">kingdom</td> <td data-bbox="983 341 1536 405">animal(ia) ;</td> </tr> <tr> <td data-bbox="741 405 983 469">phylum</td> <td data-bbox="983 405 1536 469">chordata / chordate(s) ;</td> </tr> <tr> <td data-bbox="741 469 983 533">class</td> <td data-bbox="983 469 1536 533">Reptilia</td> </tr> <tr> <td data-bbox="741 533 983 596">order</td> <td data-bbox="983 533 1536 596">Testudines</td> </tr> <tr> <td data-bbox="741 596 983 660">family</td> <td data-bbox="983 596 1536 660">Dermochelyidae</td> </tr> <tr> <td data-bbox="741 660 983 724">genus</td> <td data-bbox="983 660 1536 724"><i>Dermochelys</i></td> </tr> <tr> <td data-bbox="741 724 983 788">species</td> <td data-bbox="983 724 1536 788"><i>coriacea</i></td> </tr> </tbody> </table>		Group	Leatherback turtle classification	domain	eukaryote / eukaryota / eukarya ;	kingdom	animal(ia) ;	phylum	chordata / chordate(s) ;	class	Reptilia	order	Testudines	family	Dermochelyidae	genus	<i>Dermochelys</i>	species	<i>coriacea</i>	<b>3</b>
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species	<i>coriacea</i>																				
2(a)(ii)	<i>Dermochelys coriacea</i>		<b>1</b>																		
2(b)(i)	one organism / the remora fish, benefits (from the relationship by gaining more food) ; other organism / manta / turtle / host, neither benefits nor is harmed ;		<b>2</b>																		
2(b)(ii)	<p><i>any 3 from:</i></p> <p>increased drag <b>OR</b> decreased hydrodynamic efficiency ;</p> <p>reduces (swimming) speed ;</p> <p>more likely to be caught by a predator ;</p> <p>less likely to catch prey ;</p> <p>more food / energy required (to swim same speed / distance) ;</p>		<b>3</b>																		

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)	irregular arrangement in liquid + regular / lattice arrangement / rigid pattern in solid ; in solid / ice, molecules vibrate (in their places) + in liquid / water, molecules move past each other / move freely <b>AW</b> ;	<b>2</b>
3(b)(i)	electron(s) (from the hydrogen atom) ;	<b>1</b>
3(b)(ii)	covalent ;	<b>1</b>
3(b)(iii)	<i>any 4 from:</i>  hydrogen atoms (in water molecule) are slightly positive(ly charged) ; oxygen atoms (in water molecule) are slightly negative(ly charged) ; due to oxygen attracting the electrons more strongly than hydrogen ; oxygen (from one water molecule) is attracted to hydrogen (in another water molecule) ; reference to dipole ;	<b>4</b>
3(b)(iv)	<i>any 3 from:</i>  in liquid / water, the molecule form fewer hydrogen bonds (with other molecules) ; this causes the molecules to be closer together (in liquid) ; therefore more molecules per unit volume ; therefore density is higher ;	<b>3</b>
3(b)(v)	<i>any 1 from:</i>  ice is a (thermal) insulator so prevents, water / organisms below from freezing ; (floating) ice forms a platform for marine organisms / mammals ; <b>AVP</b> ;	<b>1</b>
3(b)(vi)	temperature ; salinity / mineral ion(s) content / salt content ; pressure ;	<b>3</b>



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Question	Answer	Marks
4(a)	$\frac{60}{800} \times 100$ ; 7.5 ;	<b>2</b>
4(b)(i)	$\frac{4.7 \times 10^6}{7.4 \times 10^3}$ ; 635 <b>OR</b> 640 ;;	<b>3</b>
4(b)(ii)	<i>any 1 from:</i> low(er) availability / concentration of (dissolved) nutrients / minerals ; pressure too high / low ; temperature too high /low ; may be newer (therefore producer population not established) ; may be older (therefore no longer active) ;	<b>1</b>
4(b)(iii)	(vent <b>A</b> has higher productivity) so more carbon is fixed (per year) ; therefore supports food web further from the vent / plume ;	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)	<p><i>any 5 from:</i></p> <p>(increasing ocean temperature) increases solubility of salts ;            (because) water molecules have more kinetic energy ;            therefore interact more frequently with (salt) ions / water molecules (have sufficient KE to) overcome the attractive forces between the ions in salts ;            (increasing ocean temperature) decreases solubility of gases ;            (because) gas molecules have more kinetic energy ;            therefore more likely to leave solution / water ;</p>	<b>5</b>
5(b)	<p><i>any 7 from:</i></p> <p>lower carbon dioxide (dissolved) concentration means less photosynthesis ;            causing lower productivity ;            therefore smaller populations ;            lower carbon dioxide means less acidic conditions ;            named effect (less erosion) ;            lower oxygen means lower (rate of) respiration ;            therefore slower release of energy ;            therefore lower growth rate ;</p> <p>smaller populations ;  <b>AVP ;</b></p>	<b>7</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)(i)	<p><i>any 7 from:</i></p> <p>genetic diversity ; which is the variation in the genes / DNA / alleles / genotypes ; within a species ;</p> <p>species diversity ; which is the number of species ; and also their relative abundance ;</p> <p>ecological diversity ; which is variation in ecosystems on a regional + global level ;</p> <p>no single level gives full measure of biodiversity ; allows biodiversity to be considered at a global level and at an individual species level ; all three levels are linked / interrelated ; highlights the importance of every species in a stable ecosystem ;</p>	<b>7</b>
6(a)(ii)	<p><i>any 6 from:</i></p> <p>physical contribution to shorelines ; preventing erosion ; (by) reducing wave energy / height / speed ;</p> <p>providing solid substrate ; for coral polyps to attach to ;</p> <p>climate control ; zooxanthellae photosynthesising ;</p> <p>using carbon dioxide (and releasing oxygen) / therefore reducing / slowing global warming ;</p> <p>reducing ocean acidification ;</p> <p><b>AVP</b> ;;</p>	<b>6</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(b)	<i>any 5 from:</i>  habitat for (human) food species ; nursery / breeding ground ; juveniles shelter in (prop) roots ; tourism ; coastal protection ; timber / lumber source ; fuel source ; medicinal plants / products ; decrease carbon dioxide (in atmosphere) through photosynthesis ; sink / store of carbon (compounds) ;	<b>5</b>