

Cambridge International AS & A Level

MARINE SCIENCE**9693/21**

Paper 2 AS Level Data-Handling and Investigative Skills

October/November 2025**MARK SCHEME**Maximum Mark: 75

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 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level 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 descriptions 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.

PUBLISHED**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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

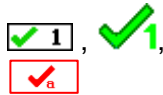
We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
	information missing or insufficient for credit
	incorrect or insufficient point ignored while marking the rest of the response
	contradiction in response, mark not awarded
	benefit of the doubt given
	error carried forward applied
	incorrect point or mark not awarded
	rounding error
	point has been noted, but no credit has been given or

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Annotation	Meaning
	blank page seen
	response is too vague or there is insufficient detail in response
	marking point 1 or marking point a is awarded. Used to mark against a particular marking point from an extended answer MS
	used to highlight parts of an answer / incorrect idea / irrelevant to question
	used to highlight parts of an extended response / incorrect idea / irrelevant to question
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
ruler	allows lengths to be measured
multi-line overlay	overlays graphs
Highlighted text	Highlighting areas of text
On-page comment box	Allows comments to be entered on the page
Off-page comment box	Allows comments to be entered at the bottom of the RM Assessor marking window and then displayed when the associated question item is navigated to

This mark scheme will use the following abbreviations:

;	separates marking points
/	alternative responses for the same marking point
R	reject the response
A	accept the response
I	ignore the response
ECF	error carried forward
AVP	any valid point / alternative valid point
ORA	or reverse argument
AW	alternative wording
underline	actual word given must be used by candidate (grammatical variants accepted)
()	the word / phrase in brackets is not required but sets the context
MAX	indicates the maximum number of marks that can be given
+ AND	statements on both sides of the + or AND are needed for that mark
OR	separates two different routes to a mark point and only one should be awarded

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Question	Answer	Marks				
1(a)	use of (appropriate) measuring cylinder to measure (stated) <u>volume</u> of (pure) water ; use of (electronic) balance to measure (stated) <u>mass</u> of (dry) salt ; description of how to produce different salinities ; mixing / stirring until (fully) <u>dissolved</u> ;	4				
1(b)	use of thermometer to, record / measure / observe, freezing point / solution freezing ; <i>idea of</i> repeated measurements for each salinity ; <i>idea of</i> calculate mean from repeats / identify anomalies ;	3				
1(c)	usable table with columns or rows, both headings as either column headings or row headings: 'salinity' AND 'freezing, point / temperature (of solution)' ; <table border="1"><tr><td>salinity / ppt</td><td>freezing, point or temperature / °C</td></tr><tr><td></td><td></td></tr></table> ppt AND °C ;	salinity / ppt	freezing, point or temperature / °C			2
salinity / ppt	freezing, point or temperature / °C					
1(d)	both axes labelled ('salinity' and 'freezing point') + any line from top left towards bottom right / bar chart with three or more decreasing height bars from left to right ;	1				

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Question	Answer	Marks
2(a)(i)	<i>type of symbiotic relationship</i> mutualism ; <i>explanation</i> coral / host, gains energy / carbohydrate / glucose (from zooxanthellae) ORA ; zooxanthellae / symbiont, gains shelter / protection / carbon dioxide (from coral) ORA ;	3
2(a)(ii)	(to make) DNA	1
2(a)(iii)	<i>any two from:</i> nematocysts, sting / stun / kill, larvae ; tentacles move larvae, into/through, the mouth ; stomach digests larvae ;	2
2(b)(i)	<i>independent variable:</i> <i>idea of</i> concentration of nitrate (NO_3^-) AND phosphate (PO_4^{3-}) <i>dependent variable:</i> <i>idea of</i> growth of coral	2
2(b)(ii)	<i>any one from:</i> no other organisms were present in the tanks ; water filtered (to remove particles) ; no additional food provided ; time results recorded for (six months) ; coral species used ;	1

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Question	Answer	Marks																										
2(b)(iii)	any two from: temperature ; pH ; salinity ; concentration of other nutrients ; light availability ; starting, mass / volume, of coral ; volume of tank / volume of water ;	2																										
2(c)(i)	both axes labelled with units scale added correctly ; points, plotted correctly $\pm \frac{1}{2}$ small square ; suitable line of best fit ; <table border="1"> <thead> <tr> <th rowspan="2">time / months</th><th colspan="2">mean percentage change in mass of the corals</th></tr> <tr> <th>normal concentration of nitrate and phosphate ions</th><th>low concentration of nitrate and phosphate ions</th></tr> </thead> <tbody> <tr> <td>0</td><td>0</td><td>0</td></tr> <tr> <td>1</td><td>15</td><td>24</td></tr> <tr> <td>2</td><td>33</td><td>32</td></tr> <tr> <td>3</td><td>54</td><td>35</td></tr> <tr> <td>4</td><td>91</td><td>41</td></tr> <tr> <td>5</td><td>158</td><td>62</td></tr> <tr> <td>6</td><td>212</td><td>80</td></tr> </tbody> </table>	time / months	mean percentage change in mass of the corals		normal concentration of nitrate and phosphate ions	low concentration of nitrate and phosphate ions	0	0	0	1	15	24	2	33	32	3	54	35	4	91	41	5	158	62	6	212	80	4
time / months	mean percentage change in mass of the corals																											
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4	91	41																										
5	158	62																										
6	212	80																										

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Question	Answer	Marks
2(c)(ii)	<i>any two from:</i> corals grow, faster, in low phosphate and nitrate in first 1 (to 2) months ; (from 2 months) the corals grow, faster, in normal concentration of phosphate and nitrate ; increase (in mass) in normal concentration increases at greater rate with time ;	2
2(d)	<i>any five from:</i> 1 idea of greater number of zooxanthellae the more intense the colour / ORA ; 2 nitrate / nitrogen stated use e.g. protein, amino acids, etc. ; 3 reduced, nitrate / phosphate, reduces availability of, nitrogen / phosphorus, to zooxanthellae / ORA ; 4 <u>zooxanthellae</u>, rate of reproduction / growth, is reduced (in low conc. water) / ORA ; 5 digested zooxanthellae cannot be replaced (as quickly) / ORA ; 6 less nutrients passed on to the corals ; 7 organic nutrient example stated e.g. glucose ;	5

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Question	Answer	Marks
2(e)	any three from: 1 data shows clear difference after first two months ; 2 data only for 6 months / no longer term data ; 3 data only for the 1 species / many other species not investigated / limited range of species ; 4 no indication of the range in the results ; 5 not all species host zooxanthallae ; 6 coral polyps also consume animals / obtain nutrients from other sources ; AVP ; ;	3

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Question	Answer	Marks									
3(a)	<table><tr><td>taxonomic hierarchy</td></tr><tr><td>domain</td></tr><tr><td>kingdom</td></tr><tr><td>phylum</td></tr><tr><td>class</td></tr><tr><td>order</td></tr><tr><td>family</td></tr><tr><td>genus</td></tr><tr><td>species</td></tr></table>	taxonomic hierarchy	domain	kingdom	phylum	class	order	family	genus	species	1
taxonomic hierarchy											
domain											
kingdom											
phylum											
class											
order											
family											
genus											
species											
3(b)	<i>outline</i>: unbroken lines in pencil and no shading ; <i>size</i>: most of the space provided and at least as big as original picture ; in proportion ; <i>detail</i> – 3 (or 4) tentacles with the upper tentacles overlapping and tentacles going into the bell ;	4									
3(c)(i)	(as depth increases) species richness / number of species, decreases ; <i>plus any one from:</i> (species richness) declines fastest in the first 1500 m / levels off below 1500 m ; correct manipulation of data ;	2									

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Question	Answer	Marks
3(c)(ii)	any three from: 1 food chains begin with phytoplankton found in surface layer ; 2 phytoplankton need light for photosynthesis ; 3 jellyfish, are consumers / eat animals, (that feed on phytoplankton) ; 4 limited motility / drift in currents so can't move great distances to obtain food ; 5 vertical migrations / found below 500 m , to reduce being predated in light ; 6 <i>ref. to</i> decrease in temperature with increasing depth ; 7 AVP ;	3
3(c)(iii)	any two from: water at the surface heated (by energy from the sun) ; decreases the density of surface water ; reduced mixing with cooler, denser water below ;	2
3(c)(iv)	<i>idea of</i> population (of each species) ;	1
3(c)(v)	genetic diversity ; (genetic diversity) variation in the genes of a species ; ecological diversity ; (ecological diversity) variation in ecosystems (on a regional and global level) ;	4

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Question	Answer	Marks
4(a)	1 fish inside the MPA take fewer bites (per minute) ORA ; 2 fish inside the MPA eat a greater area of seagrass (per minute) ORA ; <i>plus any one from:</i> 3 idea of rate of seagrass (blades) eaten inside area is approximately double compared to outside MPA ORA; 4 not a / less, significant difference in bites (per minute) inside MPA ORA ; 5 other data manipulation ; 6 AVP ;	3
4(b)	<i>any four from:</i> 1 biomass estimated from, number of fish + (mean) length, of fish ; 2 mean length of fish is greater in MPA ORA ; 3 number of fish in MPA is (significantly) greater ORA ; 4 (therefore) total biomass is (significantly) greater in MPA ORA ; 5 <i>reference to</i> consistent / similar results in each area inside MPA compared to outside the MPA ; 6 appropriate comparison of data ;	4
4(c)	fish inside the MPA, don't feed on algae / only feed on seagrass ORA ; fish inside the MPA spend longer feeding on seagrass ORA ; fish inside the MPA spend less time swimming (using energy) ORA ;	3

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Question	Answer	Marks
4(d)	<i>any two from:</i> 1 fish outside the MPA use more energy biting (as they take more bites) / ORA ; 2 fish outside the MPA eat a smaller surface area of seagrass / ORA ; 3 fish outside the MPA get less energy (from eating seagrass) / ORA ; 4 fish outside the MPA use more energy swimming / ORA ; 5 fish outside the MPA have a lower <u>growth rate</u> / ORA ; 6 AVP ;	2

Question	Answer	Marks
5(a)	the lowest part of the ocean (sediments / water) ;	1
5(b)	<i>any two from:</i> no, correlation / relationship, + no, trend / pattern / consistency, in results ; more data required to establish a relationship ; possible anomalies at site 3 / 4 and 5 ; relevant use of data to support ;	2

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Question	Answer	Marks																			
5(c)(i)	<table><tr><th rowspan="2">species</th><th colspan="3">location 1</th></tr><tr><th>n</th><th>$\frac{n}{N}$</th><th>$\left(\frac{n}{N}\right)^2$</th></tr><tr><td>Q</td><td>23</td><td>0.237 ;</td><td>0.056(0) ;</td></tr><tr><td>N</td><td>97</td><td colspan="2"></td></tr><tr><td></td><td></td><td>Σ</td><td>0.212 ;</td></tr></table> values for $\frac{n}{N}$ AND Σ to 3 sig. fig ;	species	location 1			n	$\frac{n}{N}$	$\left(\frac{n}{N}\right)^2$	Q	23	0.237 ;	0.056(0) ;	N	97					Σ	0.212 ;	4
species	location 1																				
	n	$\frac{n}{N}$	$\left(\frac{n}{N}\right)^2$																		
Q	23	0.237 ;	0.056(0) ;																		
N	97																				
		Σ	0.212 ;																		
5(c)(ii)	0.788 ;	1																			
5(d)	any three from: higher Simpson's index, value / number, indicates a, greater / higher, biodiversity ORA ; results suggest smaller catches have a higher biodiversity ORA ; results suggest no significant difference between biodiversity at different depths ; use of at least 2 data to support answer ;	3																			