

Cambridge International AS & A Level

MARINE SCIENCE**9693/23**

Paper 2 AS Level Data Handling and Investigative Skills

May/June 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 May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **16** 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 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.

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.

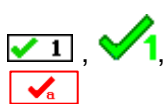
We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of 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
	allow or accept
	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
	maximum mark reached
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied

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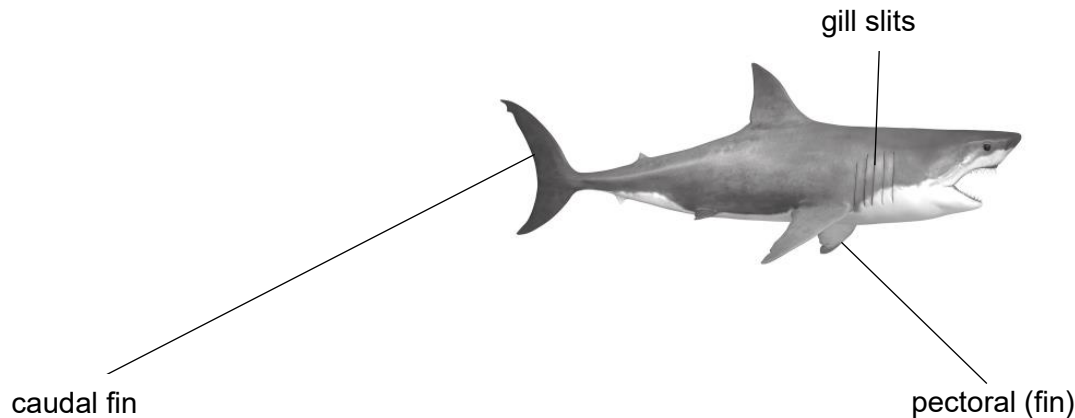
Annotation	Meaning
	point already given
	power of ten error
	incorrect point or mark not awarded
	rounding error
	point has been noted, but no credit has been given or blank page seen
	response is too vague or there is insufficient detail in response
	marking point 1 or marking point a is awarded. Used 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

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 excepted)
()	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

Question	Answer	Marks																														
1(a)	<i>idea of</i> attaching tags in a way that does not cause pain / harm to the turtles ; <i>plus any two from:</i> capturing / trapping turtles (from sea or on beach) AND attach tags AND releasing turtles back to, sea / beach ; <i>idea of</i> revisiting (same site), a year later / after suitable time period ; explanation of a suitable time period e.g. allowing tagged population to mix with untagged ; recording no. of turtles with a tag AND total no. of turtles without tags ;	3																														
1(b)	<table><tr><td>2003</td></tr><tr><td>652</td></tr></table>	2003	652	1																												
2003																																
652																																
1(c)	both axes labelled (no units) ; suitable linear scale ; point OR bars plotted correctly $\pm \frac{1}{2}$ small square ; plots joined by ruled lines OR appropriate line of best fit OR bars labelled, equal width, equidistant, with gaps ; <table><tr><td>year</td><td>2000</td><td>2001</td><td>2002</td><td>2003</td><td>2004</td></tr><tr><td>turtles captured in first sample (n_1)</td><td>247</td><td>253</td><td>292</td><td>230</td><td>309</td></tr><tr><td>turtles captured in second sample (both marked and unmarked) (n_2)</td><td>355</td><td>345</td><td>392</td><td>326</td><td>418</td></tr><tr><td>marked turtles recaptured in second sample (m_2)</td><td>108</td><td>92</td><td>100</td><td>115</td><td>109</td></tr><tr><td>estimated turtle population (N)</td><td>812</td><td>949</td><td>1145</td><td>652</td><td>1185</td></tr></table>	year	2000	2001	2002	2003	2004	turtles captured in first sample (n_1)	247	253	292	230	309	turtles captured in second sample (both marked and unmarked) (n_2)	355	345	392	326	418	marked turtles recaptured in second sample (m_2)	108	92	100	115	109	estimated turtle population (N)	812	949	1145	652	1185	4
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Question	Answer	Marks
1(d)	population increases (overall) ; decrease in population in 2003 / <i>idea of</i> anomaly in 2003 ;	2
1(e)	estimates may be inaccurate as not all the marked turtles may have been counted as marked previously ; <i>idea that</i> this would give a higher estimate of population (than those that have been calculated) ;	2

Question	Answer	Marks
2(a)(i)	 The diagram shows a shark from a side profile. Three labels with leader lines point to specific features: 'gill slits' points to the row of openings on the side of the head; 'pectoral (fin)' points to the fin on the side of the body; and 'caudal fin' points to the tail fin.	2
2(a)(ii)	Carcharodon ;	1
2(b)	Rhincodon typus ;	1

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Question	Answer	Marks
2(c)(i)	<i>idea that</i> the sharks need to be killed to identify parasites inside ; <i>idea that</i> these sharks have <u>already died</u> (as a result of being caught accidentally) / no need to deliberately kill sharks to carry out the research ;	2
2(c)(ii)	<i>advantages:</i> more difficult to be removed from the shark ORA ; more difficult to be removed by other organisms (e.g. cleaner fish) ORA ; protected habitat / environment for parasite to reproduce ORA ; easier access to (high value) nutrient sources e.g. blood ORA ; <i>disadvantages:</i> more difficult for parasite to get inside the body / more difficult for parasite to find a new host ORA ; idea that the parasite needs to evade shark's internal body defences / immune system ORA ; hard to find a mate / isolated population / reduces genetic variation ORA ;	4
2(c)(iii)	<i>any two from:</i> segmented, abdomen / body ; <u>jointed</u> legs ; two <u>pairs</u> of antennae ; carapace ;	2

Question	Answer	Marks															
2(d)(i)	<table border="1"> <thead> <tr> <th colspan="3">shark type G</th></tr> <tr> <th>n</th><th>$\frac{n}{N}$</th><th>$\left(\frac{n}{N}\right)^2$</th></tr> </thead> <tbody> <tr> <td>43</td><td>0.581 ;</td><td>0.338 ;</td></tr> <tr> <td>74</td><td></td><td></td></tr> <tr> <td></td><td>Σ</td><td>0.418 ;</td></tr> </tbody> </table> all three values correct to 3 sig. figs ;	shark type G			n	$\frac{n}{N}$	$\left(\frac{n}{N}\right)^2$	43	0.581 ;	0.338 ;	74				Σ	0.418 ;	4
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2(d)(ii)	shark species F : 0.695 AND shark species G : 0.582 ;	1															
2(d)(iii)	(shark) species F has a, higher / more, biodiversity (of parasites) (as shark species F has a higher Simpson's value) ORA ;	1															

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Question	Answer	Marks
3(a)	temperature ; salinity ; pressure ;	2
3(b)(i)	(use a balance to) <u>measure the mass</u> ; (use a measuring cylinder) to <u>measure the volume</u> ; use of measuring cylinder AND (electronic) balance ;	3
3(b)(ii)	headings for mass and volume ; correct units for mass and volume ;	2
3(c)(i)	<i>any three from:</i> <i>idea of</i> convection currents causing plate movement ; <i>idea of</i> (mid-Atlantic / mid-ocean ridge is) divergent (plate) boundary ; <i>idea of</i> molten rock / lava / magma, moving up from mantle ; <i>idea of</i> solidification of, molten rock / magma / lava ;	3
3(c)(ii)	933.25	1

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Question	Answer	Marks
3(c)(iii)	<i>any two from:</i> <i>idea that</i> pores could vary in size ; <i>idea that</i> the conditions in the eruption could be different e.g. temperature or cooling rates ; <i>idea that</i> samples may come from different eruptions / contain different minerals ; <i>idea that</i> water may not enter all the pores ; <i>idea that</i> magma contains variable volumes of gas ;	2
3(c)(iv)	<i>any four from:</i> <i>idea that</i> density of samples is, less / lower, than density of water ; pumice will float ; <i>idea that</i> it is difficult to <u>fully</u> submerge the samples ; <i>idea of</i> may not be dry / water may be in the holes in the rock ; <i>idea of</i> increased mass recorded ; <i>idea of</i> decreased volume recorded ; <i>idea of</i> temperature not 20 °C AND affecting, density / volume ;	4
3(d)(i)	<i>idea that</i> (horizontal / surface) currents move the pumice ; <i>idea that</i> oceans and sea are all connected ;	2
3(d)(ii)	<i>idea that</i> weathering has occurred ; description of physical weathering as stones / rocks banging against each other (resulting in rounded shape) ; <i>idea of</i> deposition of sediment onto beaches ;	3

Question	Answer	Marks										
4(a)	outline: unbroken lines and no shading ; size: most of the space provided and at least as big as original picture ; in proportion ; detail – bell section and three oral arms section ;	4										
4(b)(i)	<i>any three from:</i> 1 enables collection of more, data / information ; 2 (data collected from) a larger / greater, area ; 3 free / cheaper, to collect ; 4 increased awareness in conservation ; 5 <i>idea of</i> more effective use of scientists time ;	3										
4(b)(ii)	<i>any one from:</i> <table><tr><td></td><td>disadvantage:</td></tr><tr><td>1</td><td>identification may be incorrect ;</td></tr><tr><td>2</td><td>could be duplication from different members of public ;</td></tr><tr><td>3</td><td>inaccurate estimates of numbers ;</td></tr><tr><td>4</td><td>variation in ease of submission due to connectivity to internet</td></tr></table>		disadvantage:	1	identification may be incorrect ;	2	could be duplication from different members of public ;	3	inaccurate estimates of numbers ;	4	variation in ease of submission due to connectivity to internet	1
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Question	Answer	Marks										
4(b)(iii)	any one from: <table><tr><td></td><td>how to limit disadvantage:</td></tr><tr><td>1</td><td>provision of key to help public make correct identification ; ask public to provide photos so some or all of sightings can be checked</td></tr><tr><td>2</td><td>use of location data to identify reportings from a location (e.g. per day or week) ;</td></tr><tr><td>3</td><td>offer citizens training on estimating numbers ;</td></tr><tr><td>4</td><td>ability to save and submit reporting later ;</td></tr></table>		how to limit disadvantage:	1	provision of key to help public make correct identification ; ask public to provide photos so some or all of sightings can be checked	2	use of location data to identify reportings from a location (e.g. per day or week) ;	3	offer citizens training on estimating numbers ;	4	ability to save and submit reporting later ;	1
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4	ability to save and submit reporting later ;											
4(b)(iv)	any one from: (jellyfish) stings ; AVP ;	1										
4(b)(v)	any two from: warning of risk to participants ; identification of (very) dangerous species ; advice on how to treat stings ;	2										
4(c)(i)	any two from: increase in nutrients will increase productivity / rate of photosynthesis ORA ; (idea of) greater availability of food in food chains ORA ; (idea of) jellyfish are animals / consumers ;	2										

Question	Answer	Marks
4(c)(ii)	<i>any one from:</i> limited motility / swept in by strong currents / wave action ; competition for food / insufficient food ; the greater the population, the greater the <u>chance</u> of jellyfish being washed up ;	1
4(c)(iii)	line showing similar trend to phytoplankton mass ; time delay for both peaks ;	2
4(d)(i)	increases AND decreases ; peaks in 2013 ;	2
4(d)(ii)	300 (%) ;	1
4(d)(iii)	<i>any three from:</i> no information about nitrate and phosphate availability in graph ; <i>idea that</i> information is only annual / time intervals are too large ; different species peak at different times ; different species show different trends / patterns ; AVP ;	3