

Cambridge International AS & A Level

MARINE SCIENCE**9693/23**

Paper 2 AS Data-Handling & 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.

This document consists of **17** 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.

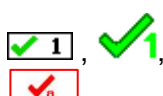
We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of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

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Annotation	Meaning
	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 accepted)
dashed underline	the phrase underlined must be used by the candidate (similar wording 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)(i)	outline: unbroken lines and no shading ; size: most of the space provided and at least as big as original picture ; in proportion ; detail ;	4
1(a)(ii)	reference to more than 5 arms OR has 7 arms ;	1
1(b)	<i>any one from:</i> lost to predator ; lost due to wave action ; lost during reproduction ; AVP ;	1
1(c)(i)	<i>any one from:</i> (water) temperature ; dissolved oxygen concentration ; salinity ; pH ; AVP ;	1

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Question	Answer	Marks
1(c)(ii)	correct numbers for mm and time read from line of best fit ; correct calculation of mm / time ; answer correctly rounded to 2 sig figs ;	3
1(c)(iii)	Yes + as gradient for 1 arm re-growing is steeper than gradient for 2 arms ; <i>and one from:</i> however, sample size not known / mean starting lengths different ; reference to significant difference / need for statistical analysis ; may have collected different species / ages / genders ; calculated difference of 0.1 mm per day ; difference in feeding ability ; no control group (growth of starfish with all limbs intact) AW ; AVP ;	2

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Question	Answer	Marks
1(c)(iv)	safety – any one from: reference to safety when collecting starfish on shoreline e.g. don't go alone / awareness of tides / suitable footwear / using gloves to avoid stings or infection or cuts ; ethical – any one from: reference to avoidance of further damage to starfish ; provide hiding places for the starfish ; provide a rock for starfish to pull themselves out of the water ; starfish released at same shoreline they were collected from ; AVP ;	2

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Question	Answer	Marks
2(a)(i)	water expanding as it freezes (due to hydrogen bonding) ; reference to hazard of broken glass / plastic is flexible ;	2
2(a)(ii)	stated mass of salt / sodium chloride ; <u>dissolved</u> in stated volume of water ;	2
2(a)(iii)	add <u>known volume</u> of stock solution to measuring cylinder ; top up with distilled water to correct stated volume ;	2
2(b)(i)	both axes labelled with units ; suitable linear scale ; points, plotted correctly $\pm \frac{1}{2}$ small square (including 0,0) ; suitable line ;	4
2(b)(ii)	correct reading from their plotted graph ;	1
2(c)	addition of <u>fresh</u> water ; <i>plus any one from:</i> from precipitation / rain ; from run-off ;	2
2(d)(i)	Universal Indicator is not sensitive enough to distinguish differences ; pH probe is more precise ;	2

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Question	Answer	Marks
3(a)	oxygen ;	1
3(b)(i)	distance between the lamp and the macroalga, varies / is independent variable ; count number of bubbles produced per minute / unit time OR number of bubbles produced per minute / unit time, is dependent variable ; reference to sufficient range (min 3 distances) ; allow time for macroalga to adjust ; reference to control variable e.g. pH / size of macroalga / same macroalga / temperature / ambient light / known volume of sea water ; repeat with species X and Y / with the two different species ; reference to repeats to, identify <u>anomalies</u> / calculating <u>mean</u> ;	5
3(b)(ii)	table with column headings for distance of lamp AND bubbles per minute / number of bubbles ; columns / rows for both species X and Y ; suitable units for independent and dependent variables ;	3
3(b)(iii)	increasing light intensity increases rate of photosynthesis ORA ;	1

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Question	Answer	Marks
3(c)	<i>any two pairs from:</i> 1 use gas syringe / (inverted) measuring cylinder ; to measure <u>volume</u> of oxygen produced ; 2 use transparent screen ; to prevent heating effect of lamp ; 3 AVP ;;	4
3(d)	<i>any three from:</i> transfers <u>energy</u> from light ; glucose / carbohydrate / organic substances , in producers ; to produce biomass (in consumers) ; provides oxygen <u>for respiration</u> ;	3

Question	Answer	Marks
4(a)	bare, sea wall / human-made surface ; of same size area / at same depth ;	2
4(b)(i)	0.172 ; $1 - 0.172 = 0.828$;	2

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Question	Answer	Marks
4(b)(ii)	reference to value closer to 1 indicating greater biodiversity ; both designs have greater biodiversity than control area ; design B has greater biodiversity than A ;	3
4(b)(iii)	<i>any three from:</i> supported as all designs show increased diversity compared to control ; (however) only one human-made structure investigated ; (however) only one, sea area / coast investigated ; (however) relatively small sample size ; (however) investigation only lasted 12 months ; investigation only performed once ; AVP ;	3

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Question	Answer	Marks
4(c)	<i>any three from:</i> may provide different surface for secure attachment by organisms ; different shapes may have different degrees of shading at low tide ; different shapes may hold different volumes of water at low tide ; may be made of different materials ; size of hollows / crevices may affect how many, individuals / species, can occupy them ; larger surface area ; idea of not being a uniform habitat ; AVP ;	3
4(d)	<i>any three from:</i> maintaining stable ecosystems ; protection of the physical environment ; providing food sources / increased opportunity for harvesting ; as a <u>source</u> of pharmaceuticals / medicines ; climate control / reduces global warming ;	3

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Question	Answer	Marks
5(a)(i)	weathering, wears away / breaks down /dissolves, rocks ; erosion is the, movement / transport, of sediments ;	2
5(a)(ii)	any two from: wind ; ice / glacial erosion ; gravity ;	2
5(b)(i)	$1.07 - 0.51 = 0.56$;	1
5(b)(ii)	any three from: sinking speed the same for all diameters initially ; the smaller the diameter the lower the maximum sinking speed ORA ; the smallest diameter reaches maximum sinking speed sooner ORA ; the larger the sediments the less the difference in maximum sinking speed ORA ; correct use of manipulated data ;	3

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Question	Answer	Marks
5(b)(iii)	<i>any one from:</i> density of <u>particle</u> material ; temperature of the water / fluid ; shape / texture, of each particle sinking ; movement of water ; density <u>of the water</u> / <u>fluid</u> ;	1
5(c)(i)	<i>any two from:</i> prop roots ; help slow, water flow / current speed ; allows increased deposition / sedimentation ; <u>stabilise</u> settled sediments ;	2
5(c)(ii)	<i>any two from:</i> stabilises / protects, coastline ; prevents sediment build up on coral reefs / seagrass beds ; (removing sediment) increases light intensity in open ocean for phytoplankton ;	2