



Cambridge International AS & A Level

MARINE SCIENCE

9693/23

Paper 2 AS Level Data-handling and Investigative Skills

May/June 2026

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **16** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions 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	<u>'List rule' guidance</u> For questions that require <i>n</i> responses (e.g. State two reasons ...): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>. • Incorrect responses should not be awarded credit but will still count towards <i>n</i>. • 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 <i>n</i> 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

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

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Question	Answer	Marks	Guidance
1(a)	outline: clear continuous line and no shading and no gaps ; size: most of the space provided and at least as big as original picture ; in proportion ; detail :	4	fills at least half space body width not greater than body length tail length not greater than body length 6 or 7 'spikes' along top edge Line dividing left and right portions of body
1(b)(i)	√ √ X ;	1	all 3 correct for mark No mark if any empty box
1(b)(ii)	<i>any 1 from :</i> segmented abdomen ; jointed legs ;	1	A cephalothorax A segmented for jointed A limb for leg A gills I exoskeleton I shell I thorax I walking, legs / appendages I claw / chela / swimmerets
1(c)(i)	suitable linear scale chosen for each axis ; axes labelled with units ; correct plotting within 1 mm ; line of best fit ;	4	MAX 3 if drawn in pen MAX 3 if bar chart drawn (no mp4) At least half of the graph grid A axes reversed I line / plot at 0,0 A curve or appropriate straight line

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Question	Answer	Marks	Guidance
1(c)(ii)	as body width increases body mass increases ; idea of greater degree of increase with increasing growth stage / AW ;	2	A positive correlation A is (directly) proportional for mp1
1(c)(iii)	<i>any 3 from:</i> mainly / only, feed on small organic particles in first growth stage / between stages 1 and 2 ; after growth stage 2 start introducing other food sources (crustaceans, gastropods and bivalves) ; (idea of) from growth stage 4 onwards crustaceans become main food source relative to gastropods and bivalves ; dependence on small organic particles gradually reduces from growth stage 2 ; data manipulation ;	3	

Question	Answer	Marks	Guidance
2(a)(i)	genus ; species ;	2	

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Question	Answer	Marks	Guidance
2(a)(ii)	any 4 from : provided surface for attachment for organisms ; may provide shelter for organisms ; zooxanthellae photosynthetic / producers ; so make energy available to ecosystem / additional biomass available ; clam may act as food source for organisms ; ZX oxygen production available for respiration ; AVP ;	4	e.g. filters the sea water and controls phytoplankton population
2(b)(i)	408 ;	1	
2(b)(ii)	$6 \times 408 = 2448$ then $2448 / 1320 = 1.8545454545$; $1 - 1.8545454545 = -0.8545454545$; $= -0.85$;	3	ECF $6 \times$ answer from 1(b)(ii) A correct rounding at this stage A any attempted calculation correctly stated as 2 sig. figs. Must be an attempt at using the formula. R $-0.86 / 0.85$ without minus sign 3 marks for -0.85 without working 2 marks for -0.8545454545 (no sig figs and no working)
2(b)(iii)	<u>strong negative</u> correlation ; because r_s is (negative and) close to -1 ;	2	ECF from (b)(ii)

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Question	Answer	Marks	Guidance
2(b)(iv)	any 2 from: calcium (ion) concentration of the sea water affects the ability to take up calcium for shell formation ; decreased / more acidic, pH, will <u>weaken shells</u> ; AVP ;	2	I nutrients I erosion e.g. food availability as food releases energy for building shells

Question	Answer	Marks	Guidance
3(a)(i)	Idea of allows time for water in measuring cylinder to reach required temperature ;	1	
3(a)(ii)	water bath not deep enough ; harder to read the hydrometer in the water bath / ORA ;	1	A idea of water bath water will dilute sample BOD
3(b)(i)	column for temperature °C and column for density ; suitable unit for density e.g. kg m⁻³/g cm⁻³ ;	2	A 'degrees celcius' R C° / 'degrees' / 'celcius' I stated temperatures in column R units repeated in column I columns for repeats / mean
3(b)(ii)	both axes labelled, either way around ; line showing negative correlation ;	2	I units
3(c)	as temperature / energy of particles, increases, particles <u>move further apart</u> ; decreased, number / mass, of particles <u>per unit volume</u> ;	2	I ref. to evaporation and change to salinity

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Question	Answer	Marks	Guidance
3(d)(i)	(lower blubber density) will, give increased bouyancy /float more easily / surface more easily ;	1	A prevents sinking
3(d)(ii)	fatty acids AND glycerol ;	1	both needed for mark A phonetic spelling of glycerol R glycerol I triglycerides
3(d)(iii)	carbon + oxygen + hydrogen ;	1	A symbols C O H R O ₂ R h, o, c
3(d)(iv)	any 3 from: tropical water is warmer than temperate water / ORA ; (idea of) thermal energy loss to surroundings will be greater in, temperate /ORA ; lower thermal conductivity so the blubber, is a more efficient insulator / reduces thermal energy loss more than higher conductivity blubber / ORA ; higher percentage of blubber lipid content, improve insulation / prevent heat loss / ORA ;	3	A heat loss must refer to both lipid % and conductivity for mp3

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Question	Answer	Marks	Guidance
4(a)	<i>any 2 from:</i> delta formed by accumulation of sediments (over time) ; the rate of sedimentation is greater than the rate of erosion ; lower current speeds causes deposition of sediment ; islands form / islands are colonised by plants and stabilise ;	2	
4(b)(i)	add UI to sample AND compare results to (pH) colour chart ;	1	
4(b)(ii)	<i>idea of:</i> litmus not effective as always blue / can only indicate acidic or alkaline ; Universal Indicator of limited use as colours are similar ; pH probe most effective as gives a precise reading ;	3	A idea of Probe > UI > litmus A Universal indicator is qualitative or subjective I more accurate A more sensitive

Question	Answer	Marks	Guidance
4(c)(i)	EITHER any 3 from: known <u>volume</u> of water ; known <u>mass</u> of salt ; all salt <u>dissolving</u> in water ; range of different masses suggested ; OR any 3 from: stock salt water solution of <u>known concentration</u> ; measure out known <u>volume</u> ; <u>dilute</u> with known volume of <u>fresh</u> water ; range of different, salinities / volumes suggested ;	3	A suitable stated mass and volume A distilled water
4(c)(ii)	any 3 from: results support hypothesis because sample J where delta meets sea (highest salinity) has highest pH / ORA ; idea of pH decreases as samples taken, further from sea / from fresher water of delta / ORA ; (however) correlation does not mean causation ; AVP ;	3	Idea of lack of repeats / limited data e.g. Sodium chloride / NaCl does not significantly affect the pH of a solution e.g. NaCl is a neutral salt and its ions do not react with water to produce or use / donate/ accept H⁺ or OH⁻ ions which are responsible for pH changes

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Question	Answer	Marks	Guidance
4(d)(i)	500 ;	1	193.15 / 38.63 × 100 A 193.15 × 100 / 38.63 = 500
4(d)(ii)	<i>any 3 from:</i> <i>idea of:</i> sample L has greater <u>proportion</u> of larger particle sizes / ORA ; neither site has many of the <u>largest</u> particles size ; processed data from table used to support answer ; ;	3	I refs to sieve numbers only
4(d)(iii)	<i>idea of:</i> L at mouth of river but K within the delta ; (so) current speed / flow rate / energy, likely to be <u>slower</u> at K compared to L / ORA ; smaller sediments more likely to be deposited at K compared to L / ORA ;	3	Must be comparative A deposition greater than erosion

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Question	Answer	Marks	Guidance
5(a)	holdfast / stipe / gas bladders / blades ; ;	2	
5(b)(i)	<i>any 2 from:</i> temperature ; time plates are left for ; volume of extract used for each bacterium ; concentration of extract used for each bacterium ; nutrient concentration in medium / type of medium ; idea of how clear areas are measured e.g. widest distance each time ; size / diameter / paper type, of discs ;	2	I light / light intensity / salinity / bacteria / oxygen concentration / pH I amount
5(b)(ii)	<i>any 4 from:</i> Supports because (MAX 3 from): has largest zone of inhibition for 2 out of 4 microbes ; smallest zone of inhibition / least effective, for none of microbes ; has highest mean zone of inhibition ; AVP ;	4	Must have pro and con for four marks A for A and D R highest / higher for all 4 bacteria

Question	Answer	Marks	Guidance
5(b)(ii)	However (MAX 3 from): only tested on 4 types of microbe ; only 3rd most effective on microbe C OR extract 3 most effective for C ; extract 4 equally effective on 2/4 microbes ; AVP ;		e.g. lack of repeats
5(c)(i)	arsenic because... PLUS any 1 from: greatest inhibition is in extracts 1 and 4 ; arsenic is in highest concentration in these two extracts ;	2	A ref to (extract) 1 alone as highest arsenic and highest inhibition I reverse argument for extracts 2 and 3 alone
5(c)(ii)	(extract) 3 as has highest magnesium content ;	1	A Mg R MG or mg if symbol only
5(d)	(keyhole limpet) hemocyanin ; anti-cancer drug ;	2	A KLH A for treating cancer Enhanced immune response / immunotherapy Carrier protein (for antibodies) Vaccine development