

Cambridge International AS & A Level

MARINE SCIENCE

9693/22

Paper 2 AS Data Handling and Investigative Skills

May/June 2024

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **10** 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.

- 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
<u>underline</u>	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)(i)	zooxanthellae need light + carbon dioxide (from air) ; (for) photosynthesis ; coral polyp / zooxanthellae, requires oxygen (from air) ; (for) respiration ;	4
1(a)(ii)	independent: temperature ; dependent: number of (healthy / damaged) zooxanthellae (released) ;	2
1(b)(i)	1840 indicated ;	1
1(b)(ii)	550 ; 1530 / 1533 ;	2
1(b)(iii)	total height of the bar correct at 2080, same width as other bars / drawn with ruler ; shaded black bar starting at 550 ;	2
1(b)(iv)	<i>any 2 from:</i> (before and after change) mean total released similar, so does not support ; after change, more damaged cells released / fewer healthy cells released, which partially supports ; <i>idea of</i> it is the change in temperature which causes the release / during transition more of both types are released, which supports ; data manipulation ;	2
1(c)	(read from graph = 2200) (2200 / 0.04) ; $\times 100 = 5.5 \times 10^6 / 5\,500\,000$;	2

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Question	Answer	Marks
2(a)(i)	clear outline with thin lines with no shading, no gaps ; suitable size ; proportion distinct 'snout' / caudal fin less than half, more than 1/3 body length, correct body shape ; detail (both eyes shown, delineation between body, and dorsal and anal fins) ;	4
2(a)(ii)	straight line drawn (no arrowhead) touching each part ;;;	3
2(a)(iii)	<i>any 2 from:</i> juveniles have to float to be in the zooplankton / larvae are free swimming (in the water column) ; (because) they cannot swim against a current / being buoyant reduces the energy demand for, swimming / maintaining position / keeps them closer to their, food / phytoplankton ; adults (remain on sea bed, so) do not need buoyancy ;	2
2(b)	E ; B ;	2
2(c)	<i>any 2 from:</i> (bony fish have) ossified or calcified, skeleton / (cartilaginous fish have) non-ossified / non-calcified ; (bony fish have) operculum / (cartilaginous fish have) gill slits ; (bony fish have) lack denticles OR scales (cover the body) / (cartilaginous fish have) denticles (cover the body) OR no scales ; (bony fish have) visible lateral line / (cartilaginous fish have) lateral line not visible ;	2

Question	Answer	Marks
3(a)	$128 \times 97 = 12416$; $12416 / 64 = 194$;	2
3(b)(i)	<i>any 5 from:</i> grid the area of the reef, with a map / GPS ; use of, line / belt, transect (laid along recovering reef) ; of known or given suitable length (e.g. 10 m) / width (1–2 m) ; use of quadrat OR take photographs over a measured area ; of suitable stated size (e.g. between 25 cm square – 50 cm square) ; place (quadrat) at, stated / every other metre (along the transect) / at regular intervals ; count number of (juvenile) polyps ; <i>idea of</i> , repeat(s) count along each transect / repeat (along different transects) + mean calculation ; ref. to calculation of density number per area of polyps / m ² ; AVP ;	5
3(b)(ii)	<i>any 3 from:</i> fewer sea urchins means less grazing of algae / less sea urchins means more algal growth ; greater percentage/ more, of reef / rocks, covered in algae ; (so) polyps cannot find attachment site on bare rocks ; algae (growing over the polyps) may block light from (coral polyps) zooxanthellae ; manipulation of data ;	3
3(c)	omnivores may feed on coral polyps as well as algae (reducing recolonisation) ;	1

Question	Answer	Marks
4(a)(i)	<p><i>any 2 from:</i> increasing water temperature increases rate of photosynthesis ; ref. to (rapid) photosynthesis drop between June / July to August while temperature stays high ; idea of, photosynthesis rate has a second peak (in October) ; ref. to lag period between temperature increase and photosynthesis increase ;</p>	2
4(a)(ii)	<p>graph showing similar shape to photosynthesis line 2 peaks and 2 troughs with the peaks up to 1 month after the phytoplankton line ;; (for 2 marks) graph showing similar shape to photosynthesis line 2 peaks and 2 troughs ; (for 1 mark)</p>	2
4(b)	<p><i>any 5 from:</i> 1 J has higher sediment loading / higher turbidity due to high runoff from land carrying sediment ORA ; 2 J has more fine particles of sediment as particles have not been able to settle out ORA ; 3 J has higher, flow rate / speed / velocity, of water due to large volume of water flowing in narrow channel ORA ; 4 J has lower <u>salinity</u> as river water is freshwater (so little salt present) ORA ; 5 J has lower pH as freshwater has a pH of 7 / sea water has a pH of (around) 8.2 ORA ; 6 J is higher in, nutrients/ minerals, due to run-off from land ORA ; 7 J has higher concentration of, oxygen / CO₂, as gas saturation decreases with increasing salt concentration ORA OR due to increased turbulence at J, ORA ; 8 J will be less dense as it contains fewer salts ORA ; 9 J may carry more, toxins / pollutants / named pollutant, from runoff ;</p>	5
4(c)(i)	<p>$(0.05 - 0.14) = -0.09$; $0.09 / 0.14 \times 100 = -64.29\dots$; -64 (%) ; OR $0.05 \div 0.14 \times 100 = \text{MP1}$; $100 - (\text{MP1})$; -64.29 ;</p>	3

Question	Answer	Marks
4(c)(ii)	<p><i>any 4 from</i> (decrease in summer)</p> <ol style="list-style-type: none"> 1 (summer) absorbed by phytoplankton / algae / plants ; 2 (uses of phosphate) DNA / RNA / ATP / bone ; 3 to increase productivity ORA ; <p>(increase in winter)</p> <ol style="list-style-type: none"> 1 flooding occurs in winter / more precipitation in winter ; 2 increase in fertiliser / sewage (from runoff) ; 3 (increased) river run-off / upwelling ; 4 (winter) stormy conditions causes greater mixing of nutrients from the seabed ; 	4
4(c)(iii)	<p><i>any 3 from:</i> used to make amino acids / protein / DNA / chlorophyll ; less, (protein / DNA) for growth / repair of cells / cell division / photosynthesis by producers / biomass formed ; (less) <u>energy</u> to pass along food chain / less food available further up the food chain ; reduces productivity at all levels / a named level ;</p>	3
4(d)(i)	temperature / pH / salinity / water volume / carbonate or hydrogen carbonate or carbon dioxide, concentration ;	1
4(d)(ii)	<p><i>any 5 from:</i> changing distance of light source / how light intensity is changed ; ensure ambient light is low ; presence of glass screen / water bath (to ensure not heated by lamp) ; ref. to specimen in beaker / test tube / flask / container ; allowing specimen time to adjust to light intensity ; means of measuring the volume of gas released / count the bubbles ; in a stated time period ; ref. to hydrogen carbonate source in water / maintaining carbon dioxide concentration ; ref. to repeating / 3 sets of data collected, at each light intensity + calculate the mean ;</p>	5

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Question	Answer	Marks														
4(d)(iii)	<table border="1"> <tr> <td rowspan="2">distance from light source / cm</td> <td colspan="4">volume of oxygen collected per minute / cm³ OR number of bubbles / minute</td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>mean</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>column / row, for distance and mm / cm / m ; column / row, for volume of oxygen collected + cm³ / number of bubbles counted + per minute ; column / row, for repeats at least 3 sets of results / mean ;</p>	distance from light source / cm	volume of oxygen collected per minute / cm ³ OR number of bubbles / minute				1	2	3	mean						3
distance from light source / cm	volume of oxygen collected per minute / cm ³ OR number of bubbles / minute															
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Question	Answer	Marks
5(a)	<p><i>any 3 from:</i></p> <ol style="list-style-type: none"> 1 low in high latitudes / none at 55 °N and °S ; 2 (then) decreases close to the equator ; 3 in the N, number increases to 10° then decreases ORA ; 4 in the S, the number fluctuates but peaks at 25° and then decreases ; 5 greater diversity in the Northern hemisphere ; 6 AVP ; 	3
5(b)(i)	mean sea surface temp. ;	1
5(b)(ii)	continental shelf area ;	1
5(b)(iii)	(strong) negative (correlation) ;	1
5(b)(iv)	<p><i>any 2 from:</i></p> <p>correlation in N hemisphere is negative ; in S hemisphere weakly positive ; overall (very) low correlation so unlikely to be causation ; AVP ;</p>	2