



Cambridge International AS & A Level

MARINE SCIENCE

9693/11

Paper 1 AS Level Theory

May/June 2023

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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 descriptors 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	<p><u>'List rule' guidance</u></p> <p>For questions that require <i>n</i> responses (e.g. State two reasons ...):</p> <ul style="list-style-type: none">• 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.

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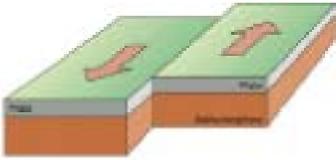
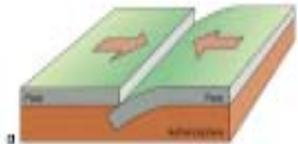
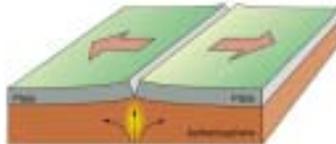
- This mark scheme will use the following abbreviations:

;	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)

Question	Answer	Marks
1(a)	<p>macroalga</p> <p>stipe</p> <p>gas bladder</p> <p>holdfast</p> <p>blade</p> <p>both</p> <p>photosynthetic</p> <p>primary producer</p> <p>seagrass</p> <p>flowers</p> <p>rhizome</p>	2

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Question	Answer	Marks
1(b)	<p><i>any 4 of:</i></p> <ul style="list-style-type: none"> (a) absorbs carbon dioxide / releases oxygen ; (b) helps to control global climate / is a carbon sink / reduces acidification ; (c) provides nursery grounds ; (d) economically important fish or shellfish species / employment in fisheries / fisheries activity ; (e) provides feeding grounds for, large mammals / seabirds (named) / (sea) turtles / fish or invertebrate or organisms, which are human food sources or named (e.g. crabs or sea urchins) ; (f) brings divers / tourists ; (g) nutrient recycling / absorbs, nutrients or pollutants, in runoff ; (h) reduces coastal erosion / traps sediment / reduces sediment reaching coral reefs / reduces wave action ; (i) AVP ; 	4
1(c)	<p>high, species richness / a large number of / many, species / types of macroalgae ;</p> <p>an abundance of, or high, numbers / population, of each species / types ;</p>	2

Question	Answer			Marks
2(a)	plate boundary type	direction of movement of plates	one feature or event produced at the boundary	3
transform		earthquakes		
convergent		<i>any 1 of:</i> subduction / volcanoes / tsunami / trench / mountain (ranges) ;		
divergent		<i>any 1 of:</i> hydrothermal vents / volcanoes / (mid-oceanic) ridge / sea floor spreading ;		

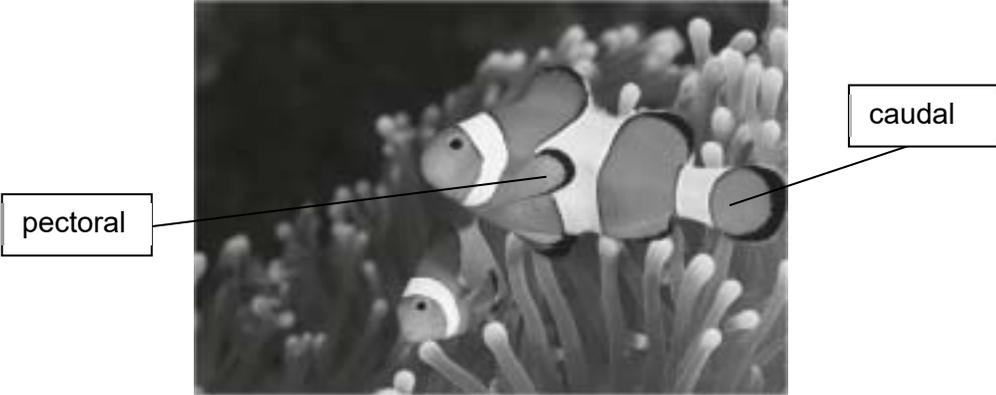
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Question	Answer	Marks
2(b)	<p>any 3 of:</p> <p>(a) jigsaw fit of continents (coastlines) ;</p> <p>(b) matching of, rock composition / mountains, formations on different continents ;</p> <p>(c) distribution of, same / similar, fossil species on different continents ;</p> <p>(d) distribution of living animals of similar species on different continents ;</p> <p>(e) paleomagnetic stripes on seabed ;</p> <p>(f) coal deposits in, cold regions / Antarctica ;</p> <p>(g) glacial deposits / glacial scarring, on different continents;</p> <p>(h) earthquakes / volcanoes / mid-oceanic ridge / mountain ranges / seafloor spreading ;</p>	3

Question	Answer	Marks
3(a)	<p>any 2 of:</p> <p>(a) physical or mechanical / chemical / organic ;</p> <p><i>plus 2 matching descriptions from any two different types of weathering;;</i></p> <p>(physical or mechanical)</p> <p>(b) force / impact, of waves breaks rocks or hydraulic action (of the water) or sand / airborne particles, causes, abrasion / wearing away of material (due to, collision of rocks / pebbles / sand) or water freezes in cracks, forcing them further apart / breaking the rock or thermal stress or description</p> <p>(chemical)</p> <p>(c) acid rain / carbonic acid / salts / chemicals / rusting of iron in rocks + dissolving rock ;</p> <p>(organic)</p> <p>(d) organisms grow, in cracks / on rocks + (roots) force the rock apart or animals, boring / digging, into rocks or bacteria (causing weathering) to extract nutrients from the rocks ;</p>	3
3(b)(i)	Accept anything within the range of 15.6–16.3 ;	1
3(b)(ii)	12:05 – 12:10 ;	1

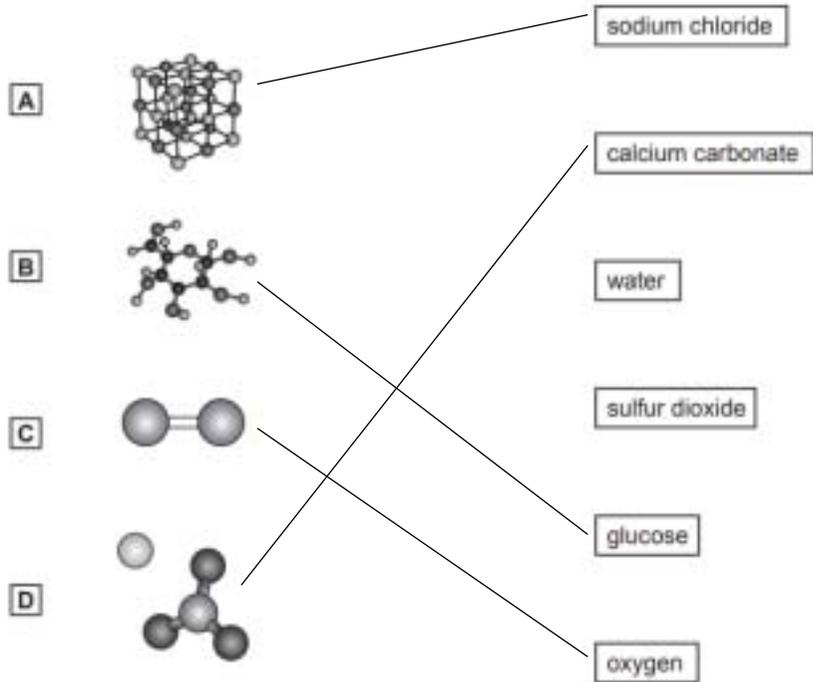
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Question	Answer	Marks
3(c)	<p><i>any 2 of:</i></p> <p>predation + predation reduces population size / increases space between individuals ;</p> <p>competition + food / space / other named resource ;</p> <p>disease + reduces population ;</p> <p>AVP ;</p>	2

Question	Answer	Marks
4(a)(i)		2
4(a)(ii)	Cnidaria ;	1
4(a)(iii)	clownfish has notochord / dorsal neural tube / pharyngeal slits / post-anal tail ;	1
4(b)	<p>(a) (contain) zooxanthellae that photosynthesise ;</p> <p>(b) (anemones) receive, nutrition / energy, from the zooxanthellae, so on trophic level 2 ;</p> <p>(c) they use nematocysts to catch / kill (animal) prey ;</p> <p>(d) prey species are consumers in trophic level 2, so sea anemones, are in the next trophic level / trophic level 3 ;</p>	4
4(c)(i)	anemone released it (as waste / excess nutrients) / (waste / nutrients) absorbed by the zooxanthellae ;	1

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Question	Answer	Marks
4(c)(ii)	amino acids / protein / DNA / enzymes ;	1
4(d)	<i>any 2 of:</i> increase in pectoral fin stroke rate ; increase in caudal fin stroke rate ; data manipulation ;	2
4(e)	(a) predator-prey because clownfish eat sea anemone eggs ; (b) mutualistic ; (c) (because) clownfish provide food / nutrients / oxygen (to anemone) ; (d) anemone provides <u>protection</u> (for clownfish from predators) / clownfish provides protection (for anemones from predators) ;	4

Question	Answer	Marks										
5(a)(i)	 <p>The diagram shows four molecular models labeled A, B, C, and D. Model A is a cubic lattice of spheres representing sodium chloride. Model B is a complex organic molecule representing calcium carbonate. Model C is two spheres connected by a double bond representing sulfur dioxide. Model D is a central sphere with four other spheres around it representing oxygen. Lines connect A to sodium chloride, B to calcium carbonate, C to sulfur dioxide, and D to oxygen. Water and glucose are listed but not connected to any model.</p>	2										
5(a)(ii)	<table border="0"> <thead> <tr> <th data-bbox="376 979 501 1011">molecule</th> <th data-bbox="658 979 779 1011">bonding</th> </tr> </thead> <tbody> <tr> <td data-bbox="421 1043 450 1075">A</td> <td data-bbox="680 1043 757 1075">ionic</td> </tr> <tr> <td data-bbox="421 1107 450 1139">B</td> <td data-bbox="658 1107 779 1139">covalent</td> </tr> <tr> <td data-bbox="421 1171 450 1203">C</td> <td data-bbox="658 1171 779 1203">covalent</td> </tr> <tr> <td data-bbox="421 1235 450 1267">D</td> <td data-bbox="680 1235 757 1267">ionic</td> </tr> </tbody> </table>	molecule	bonding	A	ionic	B	covalent	C	covalent	D	ionic	2
molecule	bonding											
A	ionic											
B	covalent											
C	covalent											
D	ionic											

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Question	Answer	Marks
5(b)	<p><i>any 4 of:</i></p> <ul style="list-style-type: none"> (a) hydrogen bonding present in water / no or weak, attractive forces / no hydrogen bonds, between SO₂ molecules ; (b) (the hydrogen bonds are) strong enough to keep water molecules closer to each other / SO₂ molecules can move further apart ; (c) therefore a higher temperature / more energy, is needed (in water) to break the bonds / turn into a gas ORA ; (d) oxygen atom has slight –ve charge ; (e) hydrogen atom has slight +ve charge ; (f) develop electrostatic forces between molecules / opposite charges attract ; (g) (on an) oxygen atom in another water molecule ; 	4

Question	Answer	Marks
6	<p>(cartilaginous fish)</p> <ul style="list-style-type: none"> (a) has gill slits ORA ; (b) cartilaginous <u>skeleton</u> / non-calcified or non-ossified, skeleton ; (c) buoyancy created by fatty liver ORA ; (d) constant swimming ORA ; (e) denticles present / <u>placoid</u> scales ; <p>(bony fish)</p> <ul style="list-style-type: none"> (f) skeleton is <u>calcified</u> / <u>ossified</u> ; (g) operculum present ORA ; (h) to, cover / protect, gills ; (i) scales present ; (j) swim bladder (present in many) ORA (absent in all cartilaginous fish) ; (k) visible lateral line ORA ; (l) correctly named bony or cartilaginous fish ; 	8

Question	Answer	Marks
7(a)	<p>MAX. 6 of: (Rocky shore)</p> <ul style="list-style-type: none"> (a) firm / stable substrate, for attachment ; (b) macroalgae have a strong holdfast ; (c) animals form, tight (shell) closure / muscular foot, to attach, (to substrate) ; (d) strong or hard, shell / shape of shell ; (e) (so can withstand) high wave impact / not be washed away ; (f) animals have shell / macroalgae have thick / leathery blades + reduce / prevent, desiccation ; (g) named example of animal (linked to its correct adaptation) ; (h) migrate with the changing tide / live or survive, in rock pools ; (i) move under, macroalgae / seaweed, or into crevices or cracks to avoid desiccation / predators ; <p>at least 3 of: (Sandy shore)</p> <ul style="list-style-type: none"> (j) constantly, moving / unstable / shifting, substrate / AW ; (k) organisms burrow ; (l) (organisms burrow / dig / bury themselves) to avoid desiccation / predation ; (m) named example of animal (linked to its correct adaptation) ; (n) producers live between sand grains ; 	9
7(b)	<ul style="list-style-type: none"> (a) interspecific is competition between species ; (b) intraspecific is competition within a species ; <p>plus any 4 of:</p> <ul style="list-style-type: none"> (c) competition for named resource, food / light / oxygen / carbon dioxide / attachment site or space or niche / mates (intraspecific only) ;; (e) interspecific competition example e.g. mussels / limpets ; (f) one species outcompetes the other ; (g) different species may develop different niches / specialised feeding habits ; (h) (which may) lead to different times of feeding / feeding at different states of tide / location on zone ; (i) AVP ; 	6

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Question	Answer	Marks
8	<p>(abiotic)</p> <p>(a) increasing salinity decreases oxygen ;</p> <p>(b) surface waters less saline, due to more precipitation than evaporation (so hold more oxygen) or surface waters more saline, due to more evaporation than precipitation (so hold less oxygen) ;</p> <p>(c) increasing temperature decreases oxygen or surface waters warm so hold less oxygen ;</p> <p>(d) surface turbulence increases atmospheric dissolution ;</p> <p>(e) as water pressure increases (with depth), more oxygen is held ;</p> <p>(f) high light intensity at surface / in photic zone increases photosynthesis ;</p> <p>(biotic)</p> <p>(g) photosynthesis increases oxygen ;</p> <p>(h) respiration decreases oxygen ;</p> <p>(i) (respiration is high) in surface waters due to availability of food / higher temperature ;</p> <p>(j) mesopelagic has lower light intensity so little photosynthesis and low(er) oxygen or bathypelagic / abyssopelagic has no light and no photosynthesis, so no oxygen production ;</p> <p>(k) eutrophication reduces oxygen ;</p>	7