

# Cambridge International AS & A Level

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**MARINE SCIENCE****9693/11**

Paper 1 AS Level Theory

**May/June 2024****MARK SCHEME**Maximum Mark: 75

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**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.

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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.

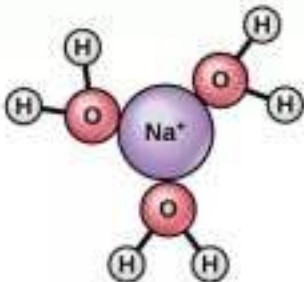
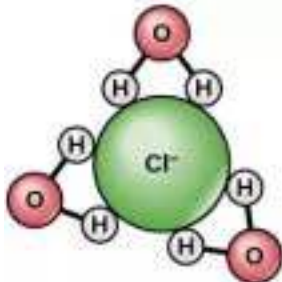
**7** Guidance for chemical equations

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.

This mark scheme will use the following abbreviations:

<b>;</b>	separates marking points
<b>/</b>	separates alternatives within a marking point
<b>()</b>	contents of brackets are not required but should be implied / the contents set the context of the answer
<b>R</b>	reject
<b>A</b>	accept (answers that are correctly cued by the question or guidance you have received)
<b>I</b>	ignore (mark as if this material was not present)
<b>AW</b>	alternative wording (where responses vary more than usual, accept other ways of expressing the same idea)
<b>AVP</b>	alternative valid point (where a greater than usual variety of responses is expected)
<b>ORA</b>	or reverse argument
<b><u>underline</u></b>	actual word underlined must be used by the candidate (grammatical variants excepted)
<b>MAX</b>	indicates the maximum number of marks that can be awarded
<b>+</b>	statements on both sides of the <b>+</b> are needed for that mark
<b>OR</b>	separates two different routes to a mark point and only one should be awarded
<b>ECF</b>	error carried forward (credit an operation from a previous incorrect response)

Question	Answer	Marks						
1(a)(i)	<table><tr><th>Name of particle</th><th>Charge of particle</th></tr><tr><td>proton</td><td>+1 / positive / +</td></tr><tr><td>neutron</td><td>0 / neutral</td></tr></table>	Name of particle	Charge of particle	proton	+1 / positive / +	neutron	0 / neutral	2
Name of particle	Charge of particle							
proton	+1 / positive / +							
neutron	0 / neutral							
1(a)(ii)	calcium carbonate ; CaCO <sub>3</sub> ;	1						
1(a)(iii)	<p>any <b>4</b> from:</p> <p>(in water molecule) oxygen is <u>slightly</u> negatively charged / hydrogen is slightly positively charged / water is, polar (molecule) / dipolar / has a dipole ;</p> <p>Cl<sup>-</sup> / Na<sup>+</sup> <b>OR</b> Cl ion / chloride, is negative <b>OR</b> / Na ion / sodium ion, is positive / because chloride / chlorine atom gains an electron from the sodium ion <b>OR</b> because sodium loses an electron to the chloride ions ;</p> <p>Cl<sup>-</sup> and hydrogen are attracted / hydrogen surrounds Cl<sup>-</sup> (to each other) / <b>OR</b> Na<sup>+</sup> and oxygen are attracted (to each other) ; separates from the lattice / breaks the <u>ionic</u> bond (in NaCl) / NaCl dissociates ;</p> <p>e.g. of diagram for MP's 2 and 3, and if they had δ+ or δ- on the oxygen or hydrogen, they would also get MP1</p> <div></div>	4						

Question	Answer	Marks
1(b)(i)	<p><i>any 3 from:</i></p> <p>(water cools so) molecules / particles, lose <u>kinetic</u> energy / move slower <b>ORA</b> ;</p> <p>(slower movement) allows formation of more hydrogen bonds between water molecules ;</p> <p>(hydrogen bonds) cause molecules to be, further apart / spread further apart, (than in the liquid state) ;</p> <p>ice is less dense so ice floats (on water) OR less molecules per unit volume so floats ;</p>	<b>3</b>
1(b)(ii)	<p><math>14.863 \div 1022</math> OR <math>14863 \div 1022000</math> ;</p> <p><math>0.01454 / 0.014543 / 0.0145431 \text{ (m}^3\text{)} ;</math></p>	<b>2</b>

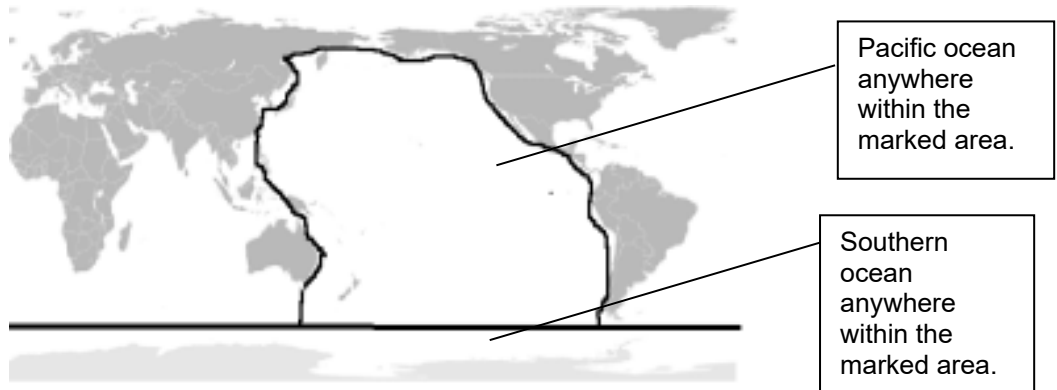
Question	Answer	Marks
2(a)(i)	<p><i>any 2 from:</i></p> <p>post-anal tail ;</p> <p>notochord ;</p> <p>dorsal neural tube ;</p> <p>pharyngeal slits ;</p>	<b>2</b>
2(a)(ii)	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">gill slits</div>  </div>	<b>1</b>

Question	Answer		Marks
2(b)(i)	group	classification for the reef shark	2
	domain	Eukarya	
	kingdom	Animalia	
	phylum	Chordata	
	class	Chondrichthyes	
	order	Carcharhiniforms	
	family	Carcharhinidae	
	genus	<i>Carcharhinus</i>	
	species	<i>melanopterus</i>	
2(b)(ii)	fatty acid(s) + glycerol ;		1
2(b)(iii)	phosphate (ion) ;		2
	nucleic acid(s) / DNA / RNA / bones / skeletal structure / teeth ;		
2(c)	reduces chance of being eaten / <u>reduce</u> predation of ascidians / protection from, <u>predators</u> / <u>sharks</u> ;  bacteria receive a named benefit;		2



Question	Answer	Marks
3(a)	<p>(weathering) is the breaking down of rocks into (smaller sizes) ;</p> <p>from, high/forceful, waves / constant wave action / drying and wetting / salt crystallisation in fissures / freeze fracture (above the splash zone) / chemical / acid rain / biological ;</p> <p><b>PLUS max. 3 from:</b></p> <p>(erosion) is the, transport/movement, of substrate (to a new location) ;</p> <p>by wind / water / waves / gravity ;</p> <p>low rates of erosion due to size of rocks / small pieces move with a smaller force ;</p> <p>erosion keeps rocky shores free of sediment / erosion (rate) is greater than sedimentation (rate) ;</p>	<b>4</b>
3(b)	<p>thick / large / deep / cage like, <u>prop</u> root <u>for stability</u> ;</p> <p>gas exchange, in <u>aerial</u> roots ;</p> <p>salt exclusion during water uptake / filter out salt ;</p>	<b>3</b>
3(c)(i)	<p><b>any 2 from:</b></p> <p>storm / hurricanes ;</p> <p>disease / parasites ;</p> <p>tsunamis ;</p> <p>fires ;</p> <p>being eaten ;</p> <p>erosion of, substrate / mud / coast ;</p> <p>invasive / alien, species ;</p>	<b>1</b>

Question	Answer	Marks
3(c)(ii)	<p><i>any 2 from:</i></p> <p>over harvesting / deforestation OR (cut down,) for building materials / firewood ;</p> <p>(clearing for,) building land / aquaculture / shrimps farms / tourism infrastructure / infrastructure / housing ;</p> <p>climate change / global warming ;</p> <p>sea level rises ;</p> <p>named pollution ;</p> <p>eutrophication ;</p>	<b>1</b>
3(c)(iii)	<p><math>1200 \div 1900 ;</math></p> <p><math>\times 100 = 63.15789 ;</math></p> <p>63.2 (%) ;</p>	<b>3</b>

Question	Answer	Marks
4(a)	 <p>Pacific ocean anywhere within the marked area.</p> <p>Southern ocean anywhere within the marked area.</p>	<b>1</b>

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Question	Answer	Marks
4(b)(i)	<p><i>any 4 from:</i></p> <ol style="list-style-type: none"> <li>tropical temperature would have higher (surface) temperature <b>OR</b> polar temperature would be lower / tropical or polar, temperature changes little through the year <b>ORA</b> ;</li> <li>August / max., (surface) temperature 14 <u>°C</u> OR March / lowest, (surface) temperatures do not drop below 4.5 <u>°C</u> / (surface) temperature range is 9.5 <u>°C</u> ;</li> <li>lack of thermocline in March / large thermocline in August ;</li> <li>(lack of thermocline in March) due to winter, mixing / turbulence / storms OR (large thermocline in August) due to stable (warm) weather ;</li> <li>definite seasons shown (in graph) due to the large change in the thermocline (position) / thermocline (position) in tropical regions, don't change significantly / August thermocline is similar to tropical thermocline ;</li> <li>because polar region does not develop a (significant) thermocline / March thermocline is similar to polar thermocline;</li> </ol>	<b>4</b>
4(b)(ii)	March ;	<b>1</b>

Question	Answer	Marks
4(b)(iii)	<p>productivity, <b>highest in March / lowest in August</b> (no MP for this statement)</p> <p><i>any 4 from:</i></p> <ol style="list-style-type: none"> <li>1 productivity is the rate of production of biomass ;</li> <li>2 high nutrient availability / ref. to upwelling in spring OR nutrients used over summer so few available in August ;</li> <li>3 (nutrient availability) due to high winter runoff ;</li> <li>4 light availability increasing for more photosynthesis ;</li> <li>5 fewer storms improve water clarity ;</li> </ol> <p><b>OR</b></p> <p>productivity, highest in <b>August / lowest in March</b> (no MP for this statement)</p> <p><i>any 4 from:</i></p> <ol style="list-style-type: none"> <li>6 productivity is the rate of production of biomass ;</li> <li>7 (primary) productivity is determined by rate of photosynthesis ;</li> <li>8 temperature cold in March, so less photosynthesis <b>ORA</b> ;</li> <li>9 fewer hours of sunlight in March, so less photosynthesis <b>ORA</b> ;</li> <li>10 light intensity less in March, so less photosynthesis <b>ORA</b> ;</li> </ol> <p><b>AVP</b> ;</p>	<b>4</b>
4(b)(iv)	carbon dioxide + water → glucose + oxygen ;	<b>1</b>

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Question	Answer	Marks
5	<p><i>any 10 from:</i></p> <ol style="list-style-type: none"> <li>1 zooxanthellae ;</li> <li>2 symbiotic / live <u>in</u> the corals (tissues) / mutualism ;</li> <li>3 (zooxanthellae) are photosynthetic ;</li> <li>4 (corals found in) shallow waters to gain sunlight / zooxanthellae use light energy for photosynthesis ;</li> <li>5 produce glucose for the polyp / excess glucose is released ;</li> <li>6 stinging cells / nematocyst / cnidoblast / cnidocyte ;</li> <li>7 (nematocyst in or on) tentacles ;</li> <li>8 fire out barb (into prey) ;</li> <li>9 contains toxin ;</li> <li>10 (toxin) which, paralyses / stuns / immobilises, prey ;</li> <li>11 (prey) passed through the mouth and into stomach for digestion ;</li> <li>12 for coral polyp to, absorb / use ;</li> <li>13 <b>AVP</b> ;</li> </ol>	10

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Question	Answer	Marks
6	<p>1 naming any 2 zones from splash zone, upper shore / zone, middle shore / zone or lower shore / zone ;</p> <p>2 organisms cannot survive outside of their range of tolerance of (named) abiotic factors ;</p> <p>3 ref. to, vertical zonation / horizontal bands ;</p> <p>4 abundance OR distribution increases <u>down</u> the shore/biodiversity increases <u>down</u> the shore <b>ORA</b> ;</p> <p>5 reference to, (named) animal, moving to rock pools, for gas exchange / prevent drying out / desiccation OR reference to (named) animal moving, under macroalgae / into crevices, to prevent drying out / desiccation ;</p> <p><i>At least 1 from:</i></p> <p><i>exposure time in air:</i></p> <p>6 higher zones have greater exposure to air / less water coverage <b>ORA</b> ;</p> <p>7 (higher zones) longer in air gives greater risk of desiccation / organisms have to be adapted to desiccation <b>ORA</b> ;</p> <p>8 higher zones have a greater range of temperatures / more temperature fluctuations <b>ORA</b> ;</p> <p>9 named adaptation to being out of the water e.g. shell closure to trap water or migrate with the tide ;</p> <p>10 ref. to spring and neap tide range differences ;</p> <p>11 named <u>linked</u> examples (mussel, limpet, macroalgae, barnacles, crab) ;</p> <p>12 reference to diurnal tides / being covered / uncovered during a day (twice a day) ;</p>	9

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Question	Answer	Marks
6	<p><i>At least 1 from:</i></p> <p><i>dissolved oxygen concentration:</i></p> <p>(a) (during high tide) dissolved oxygen (concentration) is high due to, wave action / crashing waves ;</p> <p>(b) organisms extract oxygen from the water (rather than air) ;</p> <p><i>At least 1 from:</i></p> <p><i>competition:</i></p> <p>(c) explanation of interspecific competition ;</p> <p>(d) explanation of intraspecific competition ;</p> <p>(e) correct ref. to resource competed for e.g. location, space, light, food / nutrient availability ;</p> <p>(f) harsh conditions in splash zone, so little competition / favourable conditions in lower or middle so a lot of competition ;</p>	

Question	Answer	Marks
7(a)	<p><i>any 6 from:</i></p> <ol style="list-style-type: none"> <li>1 land ice / ice sheet, is <u>fresh</u> water ;</li> <li>2 lowers / reduces, density (of seawater) ;</li> <li>3 (so it) floats on top of the ocean water ;</li> <li>4 reduces evaporation of the salt water ;</li> <li>5 salinity of surface water does not increase as much;</li> <li>6 takes longer for salt water to become dense enough to sink / water sinks more slowly / reduces sinking of seawater / reduces downwelling / reduces movement of water by convection / convection currents reduced ;</li> <li>7 (downwelling or sinking water) is the driving force (for the conveyor belt) / stops pushing water through the cycle / does not push deep water south ;</li> <li>8 (BUT) melted ice water will be cold(er) ;</li> <li>9 which is more dense ;</li> <li>10 so (may still) sink ;</li> </ol>	<b>6</b>

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Question	Answer	Marks
7(b)	<p><i>any 5 from:</i></p> <ol style="list-style-type: none"> <li>1 increased temperature / warmer water / increased ocean heat (western Pacific) ;</li> <li>2 reduced / stopped, winds blowing across the Pacific to Australia <b>OR</b> reduced / stopped Easterly winds <b>OR</b> increased, Westerly winds / winds blowing to the east ;</li> <li>3 decreased rainfall / drier / droughts ;</li> <li>4 reduces, fish catch / fish population <b>OR</b> fish migrate deeper or to cooler regions ;</li> <li>5 reduced crops / less profit for farmers or fisherfolk / less food (for the population) ;</li> <li>6 (increased) risk of, forest / bush, fires ;</li> <li>7 (increased) coral bleaching ;</li> <li>8 (increased) death of coral polyps ;</li> <li>9 decreased biodiversity on coral reefs ;</li> <li>10 fewer, cyclones / hurricanes / typhoons ;</li> <li>11 increased frost ;</li> <li>12 higher <u>air</u> pressure / high pressure system ;</li> </ol>	<b>5</b>