



# Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/01**

Paper 1 AS Level Theory

**For examination from 2022**

MARK SCHEME

Maximum Mark: 75

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**Specimen**

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This document has **12** pages. Blank pages are indicated.

**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 'List rule' guidance (see examples below)
 

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	<p><u>Calculation specific guidance</u></p> <p>Correct answers to calculations should be given full credit even if there is no working or incorrect working, <b>unless</b> the question states 'show your working'.</p> <p>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.</p> <p>For answers given in standard form, (e.g. <math>a \times 10^n</math>) in which the convention of restricting the value of the coefficient (<math>a</math>) 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.</p> <p>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.</p>
7	<p><u>Guidance for chemical equations</u></p> <p>Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.</p> <p>State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.</p>

### Abbreviations used in the Mark Scheme

This mark scheme will use the following abbreviations:

;	separates marking points
/	separates alternatives within a marking point
<b>OR</b>	gives alternative marking point
<b>R</b>	reject
<b>I</b>	ignore mark as if this material was not present
<b>A</b>	accept (a less than ideal answer which should be marked correct)
<b>COND</b>	indicates mark is conditional on previous marking point
<b>ECF</b>	credit a correct statement that follows a previous wrong response
( )	the word / phrase in brackets is not required, but sets the context
<b>ORA</b>	or reverse argument
<b>AW</b>	alternative wording (where responses vary more than usual)
<b>AVP</b>	alternative valid point (where a greater than usual variety of responses is expected)
<b><u>underline</u></b>	word underlined must be used by the candidate (grammatical variants accepted)
<b>+</b>	statements on both sides of the + are needed for that mark
<b>max</b>	indicates the maximum number of marks that can be awarded

**Examples of how to apply the list rule**

State three reasons ... [3]

**A**

1. Correct	✓	<b>2</b>
2. Correct	✓	
3. Wrong	✗	

**B (4 responses)**

1. Correct, Correct	✓, ✓	<b>3</b>
2. Correct	✓	
3. Wrong	ignore	

**C (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct, Wrong	✓, ✗	
3. Correct	ignore	

**D (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct, CON (of 2.)	✗, (discount 2)	
3. Correct	✓	

**E (4 responses)**

1. Correct	✓	<b>3</b>
2. Correct	✓	
3. Correct, Wrong	✓	

**F (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct	✓	
3. Correct CON (of 3.)	✗ (discount 3)	

**G (5 responses)**

1. Correct	✓	<b>3</b>
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

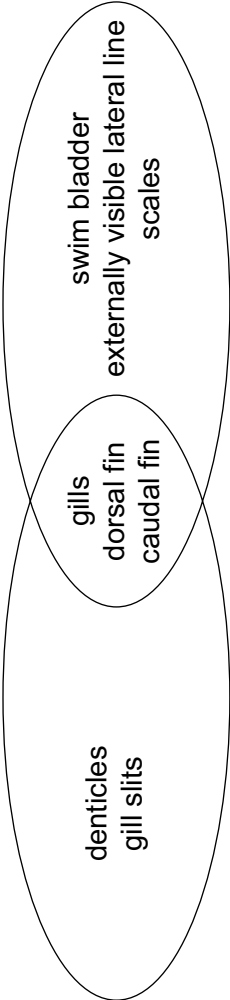

**H (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct	✗	
3. CON (of 2.) Correct	(discount 2) ✓	

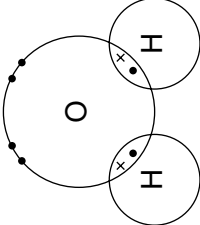
**I (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct	✗	
3. Correct CON (of 2.)	✓ (discount 2)	

**Section A**

Question	Answer	Marks	Guidance																
1(a)	<p>cartilaginous fish      both      bony fish</p> 	3	<p>1 mark for each correct part of the Venn diagram, but ignore additional incorrect features                      e.g. denticles, gill slits and swim bladder for cartilaginous fish = 1 mark                      lateral line and scales (only) in bony fish = 0 marks                      BUT, if denticles, gill slits and swim bladder for cartilaginous fish <b>and</b> swim bladder, lateral line and scales in bony fish = 1 mark only (as contradiction)</p>																
1(b)(i)		1	<p>1 clear line touching the anal fin</p>																
1(b)(ii)	<table border="1" data-bbox="901 1512 1316 1937"> <tr><td>domain</td><td>Eukarya</td></tr> <tr><td>kingdom</td><td>Animalia</td></tr> <tr><td>phylum</td><td>Chordata</td></tr> <tr><td>class</td><td>Chondrichthyes</td></tr> <tr><td>order</td><td>Carcharhiniformes</td></tr> <tr><td>family</td><td>Carcharhinidae</td></tr> <tr><td>genus</td><td><i>Prionace</i></td></tr> <tr><td>species</td><td><i>glauca</i></td></tr> </table>	domain	Eukarya	kingdom	Animalia	phylum	Chordata	class	Chondrichthyes	order	Carcharhiniformes	family	Carcharhinidae	genus	<i>Prionace</i>	species	<i>glauca</i>	2	<p>1 mark for each correct column</p>
domain	Eukarya																		
kingdom	Animalia																		
phylum	Chordata																		
class	Chondrichthyes																		
order	Carcharhiniformes																		
family	Carcharhinidae																		
genus	<i>Prionace</i>																		
species	<i>glauca</i>																		
1(b)(iii)	<p>open ocean + max / high light penetration ;</p>	1	<p><b>A</b> (approx.) upper 200 m</p>																
1(c)(i)	<p>fifth / 5th ;</p>	1	<p><b>A</b> five / 5</p>																

Question	Answer	Marks	Guidance
1(c)(ii)	line from phytoplankton to (pelagic) red crab + line from (pelagic) red crab to blue shark ; arrowheads in correct direction ;	2	
1(c)(iii)	(phytoplankton, (pelagic) red crab, shark) shorter food chain ; so less energy lost between levels ;	2	
Question	Answer	Marks	Guidance
2(a)(i)	$(4.09 - 0.42 =) 3.67$ ;	1	
2(a)(ii)	(high tide increases due to) wind blowing onshore / towards shore ; low air pressure ; OR (low tide decreases due to) wind blowing offshore / away from shore ; high air pressure ;	2	A storm surge for 1 mark
2(b)	<b>any four from:</b> ref. to gravity / gravitational effect of Sun / Moon ; 22 (July) is neap tide ; Sun and Moon at right angles to Earth ; (gravitational) forces acting against each other ; 15 (July) is spring tide ; Sun and Moon in straight line with Earth ; (gravitational) forces acting together / in same direction ;	4	I ref. to gravitational effect of Earth  idea of, resultant force is greater during spring tide, lower during neap tide <b>R</b> idea of gravitational pull increasing / decreasing, must be combined effect <b>A</b> correctly annotated diagram
Question	Answer	Marks	Guidance
3(a)	<b>any four from:</b> chlorine atom gains one electron ; sodium atom loses one electron ; to fill / complete outer (valency) shell / electron orbit ; (overall a single) <u>negative</u> charge on chloride ion <b>ORA</b> ; opposite charges (of ions) attract (to form lattice) ;	4	A has 8 electrons in outer orbit

Question	Answer	Marks	Guidance
3(b)		2	<p>1 mark for 1 O atom and 2 H atoms each drawn separately</p> <p>1 H<sub>2</sub>O</p> <p>1 non-shared electron pairs on oxygen atom</p>
3(c)	<p>any <b>two</b> from:</p> <p>water (molecule) is polar / ref. to <math>\delta^+</math> and <math>\delta^-</math> ;</p> <p>the Na<sup>+</sup> ion is attracted to the <math>\delta^-</math> oxygen atom / Cl<sup>-</sup> is attracted to the <math>\delta^+</math> hydrogen atom ;</p> <p>breaking down the NaCl ionic structure / separating the Na<sup>+</sup> / Cl<sup>-</sup> ions ;</p>	2	
3(d)(i)	<p>as depth increases salinity increases ;</p> <p>more saline water is denser and sinks ;</p>	2	
3(d)(ii)	<p>salinity increases with depth ;</p> <p>increasing salinity decreases oxygen solubility in water ;</p> <p>OR</p> <p>temperature will decrease with depth ;</p> <p>oxygen is more soluble in colder water ;</p> <p>OR</p> <p>light decreases with depth ;</p> <p>so less oxygen production from photosynthesis ;</p>	2	<p>increasing depth increases pressure ;</p> <p>increasing pressure increases solubility of oxygen in water ;</p>
Question	Answer	Marks	Guidance
4(a)	<p>the rate of production of biomass ;</p> <p>per unit area / volume ;</p>	2	
4(b)(i)	<p>polar ;</p> <p>lower temperature / lower light intensity ;</p>	2	



Question	Answer	Marks	Guidance
4(b)(ii)	<p><i>any three from:</i>            coral reefs contain many zooxanthellae / many photosynthetic organisms ;            (warm) temperatures 16–35 °C ;            shallow waters ;            clear / non-turbid water ;            (for) maximum (sun)light penetration ;            higher rate of photosynthesis ;</p>	3	
4(b)(iii)	<p>non-upwelling areas cover a much larger area <b>ORA</b> ;</p>	1	
4(c)(i)	<p><i>any three from:</i>            wind blows water offshore ;            nutrient-rich, (cold) water ;            from the sea bed to the surface ;            rises to replace it ;</p>	3	
4(c)(ii)	<p><i>any three from:</i>            increased nutrients for increased primary productivity ;            (increased) nutrients / energy transferred along the food chain ;            increases number / size of fish ;            increases catch / profit ;</p>	3	

**Section B**

Question	Answer	Marks	Guidance
5(a)	<p><i>all four of:</i> ice / glaciers move, material / rocks ; water / run-off carries sediment ; wind / blows particles to new areas ; gravity – particles tumble from high areas to low ;</p> <p><i>plus any four from:</i> rocky shore – high levels of erosion (carrying material away quickly) ; (leaves) large(r) particle sizes ; largest rocks may fall to lower shore ;</p> <p>sandy shore – low erosion levels ; deposits small sand particles (on shore) ; gentle slope ; rate of erosion less than rate of deposition ;</p> <p>muddy shore or estuary – low(est) erosion levels ; fine sediments ; flat (beach) ;</p>	8	

Question	Answer	Marks	Guidance
5(b)	<p><i>any seven from:</i>            unstable ;            easily moves / subject to wind erosion / subject to water erosion, e.g. longshore drift ;            free draining / porous / subject to drying and wetting cycles ;            no substrate for attachment ;            small particles ;            gentle slopes ;            low biodiversity ;            low productivity ;            low food availability ;            wide ecological niche ;            burrowing ;            for protection / temperature or moisture control ;            flattened (dorsally or ventrally) ;            to allow for easier burrowing ;            camouflage ;            come into water column to feed when tide is in ;            migration up and down beach with tide ;</p>	7	
5(c)	<p><i>any five from:</i>            tough / leathery leaves ;            that reduce evaporation ;            prop roots ;            provide stability on, muddy / unstable, substrate ;            (prop roots) for oxygen uptake ;            (because of) low oxygen concentrations in the substrate ;            salt exclusion by the roots ;            due to high salinity of the water ;            viviparous reproduction ;            using propagules ;            that float upright ;            so growth can start immediately a suitable substrate is encountered ;</p>	5	

Question	Answer	Marks	Guidance
6(a)	<p><i>any five from:</i>            provides a habitat to live on ;            large animals living on the upper surface ;            algae / phytoplankton attach to underside ;            thermal insulator ;            maintaining higher sea temperature in winter ;            by separating / creating barrier between colder atmosphere and water ;            prevents whole water column from freezing ;</p>	5	
6(b)	<p><i>any five from:</i>            medicines ;            named, e.g. from marine environment (e.g. KLLH) ;            food source ;            named, e.g. from marine environment (e.g. fish / shellfish / algae) ;            maintain stable ecosystem ;            environmental protection ;            named, e.g. from marine environment (e.g. coral reefs / mangroves protecting shorelines) ;            climate control ;            named, e.g. from marine environment (e.g. phytoplankton / marine plants / photosynthetic organisms absorb CO<sub>2</sub> release O<sub>2</sub>) ;</p>	5	