

# Cambridge International AS & A Level

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

Paper 1 AS Level Theory Paper

**October/November 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 October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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This document consists of **13** 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.

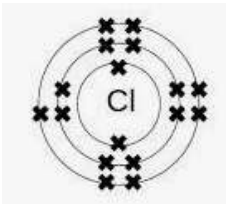
For answers given in standard form (e.g.  $a \times 10^n$ ) in which the convention of restricting the value of the coefficient ( $a$ ) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

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.

| Question  | Answer                                                                                                                                                                                | Marks |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1(a)(i)   |  <p>correct number of electrons ;</p> <p>correct arrangement / 2, 8, 7 ;</p>                         | 2     |
| 1(a)(ii)  | <p>gains an <u>electron</u> ;</p> <p><i>any 1 from:</i></p> <p>(electron) from sodium ;</p> <p>to complete its outer shell ;</p>                                                      | 2     |
| 1(a)(iii) | <p>calcium carbonate ;</p> <p><math>\text{CaCO}_3</math> ;</p>                                                                                                                        | 2     |
| 1(b)      | <p>density = mass <math>\div</math> volume <b>OR</b> <math>358.2 \div 300</math> ;</p> <p>= 1.194 ;</p> <p><math>\text{g / cm}^3</math> <b>OR</b> <math>\text{g cm}^{-3}</math> ;</p> | 3     |
| 1(c)      | <p>temperature <b>AND</b> pressure ;</p>                                                                                                                                              | 1     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | Marks |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------|--------------------------------------------|--------|---------|---------|------------|----------|---------------|-------|------------|-------|-----------|--------|-----------------|-------|----------------------|---------|-----------------|---|
| 2(a)(i)  | (penta)radial symmetry ;<br><br>tube feet ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  | 2     |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| 2(a)(ii) | <table><tr><td>group</td><td>crown of thorns<br/>starfish classification</td></tr><tr><td>domain</td><td>Eukarya</td></tr><tr><td>kingdom</td><td>Animalia ;</td></tr><tr><td>phylum ;</td><td>Echinodermata</td></tr><tr><td>class</td><td>Asteroidea</td></tr><tr><td>order</td><td>Valvatida</td></tr><tr><td>family</td><td>Acanthasteridae</td></tr><tr><td>genus</td><td><i>Acanthaster</i> ;</td></tr><tr><td>species</td><td><i>planci</i> ;</td></tr></table>                                                                           |  | group | crown of thorns<br>starfish classification | domain | Eukarya | kingdom | Animalia ; | phylum ; | Echinodermata | class | Asteroidea | order | Valvatida | family | Acanthasteridae | genus | <i>Acanthaster</i> ; | species | <i>planci</i> ; | 4 |
| group    | crown of thorns<br>starfish classification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| domain   | Eukarya                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| kingdom  | Animalia ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| phylum ; | Echinodermata                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| class    | Asteroidea                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| order    | Valvatida                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| family   | Acanthasteridae                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| genus    | <i>Acanthaster</i> ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| species  | <i>planci</i> ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |       |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |
| 2(b)(i)  | <p>(<i>idea of</i>) controlling / reducing / restricting, population of hard corals <b>OR</b> (<i>idea of</i>) creating space for settlement of, new / slower growing / soft, coral polyps <b>OR</b> (<i>idea of</i>) less competition between soft and hard coral ;</p> <p>which increases, (species/ genetic) diversity / population (of soft corals) ;</p> <p><b>OR</b></p> <p>hard coral (species /genetic) population(s) decrease <b>AND</b> no / little, effect on soft corals ;</p> <p>which decreases (species/ genetic) diversity ;</p> |  | 2     |                                            |        |         |         |            |          |               |       |            |       |           |        |                 |       |                      |         |                 |   |

| Question  | Answer                                                                                                                                                                                                                                                                                                                                     | Marks    |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2(b)(ii)  | <p>any <b>2</b> from:</p> <p>can destroy, large areas of / all (hard) corals <b>OR</b> rate of being eaten is greater than growth rate ;<br/>           due to intraspecific competition (between COTS) ;<br/>           will (start) feeding on, any coral present / soft / slow growing, corals ;<br/>           reduces diversity ;</p> | <b>2</b> |
| 2(c)(i)   | 2008 / 2009 ;                                                                                                                                                                                                                                                                                                                              | <b>1</b> |
| 2(c)(ii)  | inverse relationship <b>OR</b> hard coral decreases <b>AND</b> algae increases <b>OR</b> negative correlation <b>ORA</b> ;                                                                                                                                                                                                                 | <b>1</b> |
| 2(c)(iii) | <p>any <b>1</b> from:</p> <p>change in temperature / change in salinity / (presence of or more) hurricanes ;</p> <p><b>AVP</b> ;</p>                                                                                                                                                                                                       | <b>1</b> |
| 2(c)(iv)  | mark-release-recapture ;                                                                                                                                                                                                                                                                                                                   | <b>1</b> |

| Question | Answer                                                                                                                                                                                  | Marks    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3(a)     | <div style="text-align: center;">  </div> <p>4 correct for 2 marks<br/>2 or 3 correct for 1 mark</p> | <b>2</b> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 3(b)(i)  | <u>increased</u> , nutrients / fertiliser ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1     |
| 3(b)(ii) | <p>(phytoplankton / bloom), blocks (sun)light ;<br/>prevents seagrass, photosynthesis / growth ;<br/>manatee, has no food (seagrass) supply ;</p> <p><b>OR</b></p> <p>(some) phytoplankton contain / produces toxins ;<br/>(idea of) ingested with the seagrass ;<br/><b>AVP</b> ;</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3     |
| 3(c)     | <p>any <b>2</b> pairs from:</p> <p>stabilises sand / substrate ;<br/>(stability of substrate) reduces turbidity ;</p> <p>absorbs wave energy / reduces wave height ;<br/>(reduced wave energy) protect shorelines / reduce erosion ;</p> <p>climate control ;<br/>by absorbing carbon dioxide /carbon sequestration/ form a carbon sink ;</p> <p>produce oxygen from photosynthesis ;<br/>oxygen used for respiration ;</p> <p>form, nursery / habitat ;<br/>for commercially important species <b>OR</b> provides shelter/hiding places from predators <b>OR</b> increases biodiversity ;</p> <p>absorb nutrients from runoff ;<br/>reducing damage from eutrophication / algal blooms (on coral reefs / other named habitat) ;</p> <p>seagrass bed attracts tourists ;<br/>increased income for local population / nation ;</p> | 4     |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Marks |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4(a)(i)  | P = splash (zone) ;<br>R = intertidal / littoral, (zone) ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2     |
| 4(a)(ii) | <i>any 1 from :</i><br><br><u>low</u> air pressure ;<br><br><u>onshore</u> wind ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1     |
| 4(b)     | <i>any 4 from:</i><br><br>(when submerged) water temperature is stable / (when out of water) temperature changes rapidly ;<br><br>(when submerged) <u>dissolved</u> oxygen available (for gills) / (when out of water) exposed to, air or oxygen or much higher oxygen concentration ;<br><br>(out of water) increased light <u>intensity</u> / (submerged) low light <u>intensity</u> ;<br><br>(when out of water exposure to) wind (causing, dehydration / desiccation) / (when in water exposed to) turbulence / tidal flow / currents ;<br><br>(when out of water exposure to) increased salinity/salt concentration (as water evaporates) / (submerged) decreased salt concentration / salinity ;<br><br>(out of water) no/decreased <u>dissolved</u> nutrients ;<br><br>(when submerged) increased carbon dioxide availability / (when out of water) decreased carbon dioxide availability ;<br><br><b>AVP</b> ; | 4     |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Marks    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(c)     | <p>(organism <b>A</b>) any <b>pair</b> from:</p> <p>shell that fits to the rock / traps water in its shell / impermeable shell ;<br/>to reduce, desiccation / water loss ;</p> <p>hard shell ;<br/>for protection from waves / predators ;</p> <p>conical / grooved (shell) ;<br/>to absorb wave energy / to allow water to run off the shell / to prevent shell damage ;</p> <p>strong foot ;<br/>for attachment (to rock) / to prevent being washed off the rock / to hold it in place ;</p> <p>(organism <b>B</b>) any <b>pair</b> from:</p> <p>(strong) holdfast ;<br/>to prevent being washed away / to hold it in place ;</p> <p>air bladder ;<br/>to float (when tide in) / to keep near the surface / for (maximum) photosynthesis/ to absorb maximum light ;</p> <p>flat / long, blades ;<br/>to absorb maximal light for photosynthesis ;</p> <p>thick cuticle ;<br/>to reduce desiccation ;</p> <p>falls flat / collapses on itself ;<br/>reduces desiccation by trapping moisture ;</p> | <b>4</b> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Marks |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)     | <p><i>at least 1 from :</i></p> <p>rocks are weathered ;<br/>by chemical / physical / biological means ;</p> <p><i>plus MAX. 4 from:</i></p> <p>the pieces are eroded/ moved, by, water / wind / gravity ;<br/>large particles can settle in higher water flow ;<br/>(smaller) particles stay suspended until flow rate reduces / (fine) particles sediment out when flow rate slows ;<br/>in estuary river widens (flow reduces) ;<br/>(mangrove) prop roots (further) slow the water current ;</p>                                                                                                                               | 5     |
| 5(b)     | <p><b>MAX. 5 from:</b></p> <p>(causes of mangrove loss)<br/>over harvesting / deforestation ;<br/>storm damage ;<br/>stated change in land use ;<br/>temperature change / global warming / climate change ;<br/>oil/chemical pollution ;<br/>disease ;<br/>fire ;</p> <p><i>plus MAX. 5 from:</i></p> <p>(impacts of loss)<br/>substrate no longer stabilised / roots not present to hold the soil together ;<br/>increases (coastal) erosion ;<br/>increases turbidity, reducing productivity ;<br/>loss of biodiversity ;<br/>loss of nursery / breeding grounds ;<br/>reduced fish population ;<br/>loss of a carbon sink ;</p> | 7     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 6(a)     | <p><i>any 7 from:</i></p> <p>covalent bonds / shared electrons / electron pairs are shared ;<br/> higher positive charge on the oxygen has more attraction for the electrons / <b>ORA</b> ;<br/> leaving oxygen atom <math>\delta^-</math> / hydrogen <math>\delta^+</math> / water is a polar molecule / water is a dipole ;<br/> <math>(\delta)^+</math> of hydrogen forms (weak) bond with <math>(\delta)^-</math> of oxygen atom of another water molecule ;<br/> (hydrogen bonds are) <u>weak</u> bonds ;<br/> as water cools, kinetic energy (of the molecules) decreases <b>ORA</b> ;<br/> fixed hydrogen bonds form (as water cools) ;<br/> water molecules held apart by the hydrogen bonds / molecules less densely packed ;<br/> density of water is max. at 4 °C ;<br/> ice is less dense (than liquid water so it floats) ;</p> | <b>7</b> |
| 6(b)     | <p><i>any 5 from:</i></p> <p>it is a thermal insulator ;<br/> stops rest of the water column from freezing / limits the amount of water that freezes ;<br/> organisms don't freeze ;<br/> habitat for organisms ;<br/> for large mammals / seabirds ;<br/> to rest on / breed / escape from predators ;<br/> algae present on underside (of ice) ;<br/> (algae) is a food source ;<br/> glacial ice transfers nutrients to the ocean ;</p>                                                                                                                                                                                                                                                                                                                                                                                                   | <b>5</b> |

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| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 7        | <p><b>MAX. 5</b> from :</p> <p>cracks form at (divergent / convergent) plate boundaries ;<br/>         due to, subduction / sea floor spreading / hot spots ;<br/>         water seeps through cracks in the sea bed ;<br/>         (water is) superheated ;<br/>         by the mantle / magma ;<br/>         large quantities of (named) salts/ minerals, are dissolved into the water ;<br/>         water forced back into the ocean ;<br/>         ocean water is cold ;</p> <p><i>at least 1 of:</i></p> <p>salts / minerals precipitate (out of solution) ;<br/>         (salts / minerals) solidify and build up (forming the chimney) ;</p> | 6     |