

# Cambridge International AS & A Level

---

**MARINE SCIENCE****9693/32**

Paper 3 A Level Theory

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

---

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

---

This document consists of **14** 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.

**Key Points**

- Refer to the *Instructions for Examiners (marking scripts on-screen) 2022* booklet for details of all procedures.
- As soon as you are able (usually about two days after the paper set date), please access the question paper and provisional mark scheme from the **RM support portal**. In conjunction with the provisional mark scheme, browse scripts in **RMA<sup>3</sup>** and feed any issues or comments to your **Team Leader**.
- The decisions of the **Principal Examiner** are final, and the final agreed mark scheme must be applied as intended by the Principal Examiner. If you are in any doubt about applying this mark scheme, consult your **Team Leader** by telephone or by email.
- Please report any serious problems during marking to your **Team Leader / Principal Examiner** (details in the confidential package).
- If you require technical support, please contact the **RM Helpdesk**. If you require administrative support relating to the examination process, please contact the **Cambridge International Examiner Helpdesk**. For all queries relating to payment, please contact **Cambridge Assessment Finance Division**. Up-to-date contact details for each of these can be found in the *Instructions for Examiners (marking scripts on-screen) 2022* booklet.
- The schedule of dates is very important. It is **essential** that you meet the **Batch 1** and **Batch 2** deadlines. If you experience problems, you must contact your Team Leader without delay.
- Mark strictly to the mark scheme. All marks awarded must relate directly to the mark scheme. However, always credit correct, relevant, science, even if it lies outside of the syllabus content. For answers not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.
- Never transfer marks allocated for one question item to another.
- Where work has been crossed out, mark it when nothing else has been written.
- Do not penalise grammatical constructions/spelling of words that are not in the syllabus, so long as the meaning is clear.
- Credit should be given to all the candidate's correct responses, wherever they have been written (including blank pages, around diagrams, etc.).
- Additional materials may be attached and must be checked for candidates' responses. Show that you have checked blank pages for answers by placing an annotation on each blank page. Do not use crosses or ticks for this purpose, unless the points are credited as part of a response to a specific question. In this instance, please use the On Page Comment tool to clearly annotate which question part the marks relate to.
- If the candidate has left an answer blank, or has left a mark/comment that does not in any way relate to the question (for example 'my dog is black' or '----' or 'can't do' or '?') use the **NR** (No Response, #) option.
- Award 0 marks for any attempt which does not earn credit. This includes copying out all / part of the question or any working that does not earn any marks (whether crossed out or not).

- 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)     | difference in <u>height</u> between high tide and low tide ;  | 1     |
| 1(b)(i)  | <p><i>any 4 of:</i></p> <p>sediment covers the coral / increases turbidity of sea water ;</p> <p>blocking / reducing light ;</p> <p>less / no, photosynthesis in <u>zooxanthellae</u> ;</p> <p>less / no, food / glucose, for coral ;</p> <p>zooxanthellae expelled / coral bleaches ;</p> <p>sediment might contain toxins that poison corals ;</p> <p><b>AVP</b> ;</p>  | 4     |
| 1(b)(ii) | <p><i>any 3 of:</i></p> <p>reduce the concentration of dissolved salts in the water ;</p> <p>which <u>increases</u>, gas solubility / dissolution of gases ;</p> <p>bring dissolved nutrients from land ; <b>ORA</b></p> <p>could cause a change in the density of water ;</p> <p>could affect water temperature ;</p> <p>could affect (the depth of the), thermocline / halocline ;</p> <p>increased / changes to, water currents (around river mouth / estuary) ;</p> | 3     |
| 1(c)     | <p><i>any 4 of:</i></p> <p>stocks will <u>decrease</u> ;</p> <p>as dredging / dumping of sediment could, <u>remove</u> food sources / breeding ground / damage benthic habitat ;</p> <p>dredging creates, noise / vibrations, in the water ;</p> <p>increased sediment / covers eggs / nests, / reduces light for photosynthesis (in producers) ;</p> <p>resulting effect (of loss of habitat / food sources / noise / sediment) on fish ;;</p>                         | 4     |

| Question | Answer   | Marks    |
|----------|--|----------|
| 2(a)(i)  | <i>any 2 of:</i><br>provides <u>oxygen</u> ;<br>for <u>aerobic respiration</u> ;<br>oxygen has low solubility in water ;   | <b>2</b> |
| 2(a)(ii) | <i>any 2 of:</i><br>intensive has a higher stocking density ;<br>so greater demand / more competition for oxygen ;<br>aeration can circulate water (in tank) ;<br>so providing even distribution of, food / waste products / oxygen / pH ;<br>idea less natural <u>dissolution</u> (at surface as there is no wind / waves action) ;   | <b>2</b> |
| 2(b)     | <i>any 1 of:</i><br>(surface aerator / paddle wheel) only mixes air and water at surface ;<br>(air from jet aerator) might not reach deeper water / might only target a small area ;   | <b>1</b> |
| 2(c)     | <i>any 4 of:</i><br>nanobubbles have the least buoyancy ;<br>nanobubbles are the <u>smallest</u> in size ;<br>so have the <u>largest</u> surface area (to volume ratio) ;<br>nanobubbles take a much <u>longer time to reach the surface</u> ;<br>so more, oxygen / air, can diffuse into the water ;<br>provide a more <u>even distribution</u> of oxygen throughout tank ; | <b>4</b> |



| Question  | Answer  | Marks |
|-----------|---|-------|
| 3(a)      | <p><i>any 3 of:</i></p> <p><i>factor:</i> temperature</p> <p><i>controlled:</i> add a heater ;</p> <p><i>factor:</i> turbidity</p> <p><i>controlled:</i> use a filter to remove particles from water ;</p> <p><i>factor:</i> pH</p> <p><i>controlled:</i> add a buffer / acid / alkaline ;</p> <p><i>factor:</i> removal of waste products</p> <p><i>controlled:</i> removed by filter ;</p> <p><i>factor:</i> light</p> <p><i>controlled:</i> by installing lighting / windows or adding shade ;</p> | 3     |
| 3(b)      | <p><i>any 2 of:</i></p> <p>allows fish farmer to see if all the food is eaten ;</p> <p>easier to assess fish, health / size (as they come to the surface) ;</p> <p>less food is wasted / food is available for longer ;</p> <p>less chance of uneaten food being lost under nets / removed in outflow ;</p> <p>so more cost effective ;</p>   | 2     |
| 3(c)(i)   | deepest water will be the coolest / surface temperature too warm ;  | 1     |
| 3(c)(ii)  | <p><i>any 4 of:</i></p> <p>salmon are overcrowded ; eq.</p> <p><del>increased</del>, competition for, food / oxygen ;</p> <p>waste products / faeces / urine / waste food / dead salmon, collect here ;</p> <p>these are decomposed by (aerobic) bacteria ;</p> <p>oxygen concentration falls ;</p> <p>suitable effect on salmon ;</p>  | 4     |
| 3(c)(iii) | <p><i>any 1 of:</i></p> <p>global warming results in gradual temperature increases ;</p> <p>only based on one event ;</p> <p>could be due to another named factor ;</p>   | 1     |

| Question | Answer  | Marks    |
|----------|---|----------|
| 4(a)(i)  | <i>any 3 of:</i><br>found in, shallow water / photic zone ;<br>high light intensities ;<br>so high rate of photosynthesis ;<br>biomass increases quickly ;<br><b>AVP</b> ;  | <b>3</b> |
| 4(a)(ii) | <i>any 3 of:</i><br>provide a <u>habitat</u> (for a wide variety of commercially important species) ;<br>idea of, a nursery / spawning area, for these species ;<br>so <u>more</u> available (to harvest / sell) ;<br>ref to <u>income</u> from, tourism / source of medicines / fish sales ;<br><b>AVP</b> ;   | <b>3</b> |
| 4(b)     | <i>any 2 of:</i><br>UV radiation ;<br>wind action ;<br>wave action ;  | <b>2</b> |
| 4(c)(i)  | <i>any 2 of:</i><br>the mean numbers of microplastic per sample is greater in sediment, in a seagrass bed / on seagrass leaves, than surrounding bare sediment ;<br>manipulation of figures ;<br><br>idea of more data from bare sediment required to make a valid conclusion ;   | <b>2</b> |
| 4(c)(ii) | <i>any 3 of:</i><br>microplastic could be <u>ingested</u> by primary consumers ;<br>when they graze on, seagrass blades / phytoplankton (on surrounding sediment) ;<br><u>many</u> leaves are eaten ;<br>correct ref. to bioaccumulation ;<br>can block intestines / can be absorbed into blood ;<br>ref. to toxins + suitable effect on primary consumer ; | <b>3</b> |

| Question | Answer  | Marks |
|----------|---|-------|
| 5        | <p>any <b>10 of:</b></p> <ol style="list-style-type: none"> <li>1 takes place in, thylakoid membrane / granum ;</li> <li>2 requires light <b>and</b> water ;</li> <li>3 ref. to light as an energy source ;</li> <li>4 light absorbed by (chloroplast) pigments ;</li> <li>5 e.g. chlorophyll a / named accessory pigment ;</li> <li>6 ref. to trapping <u>specific</u> wavelengths of light ;</li> <li>7 ref. to <u>photoactivation</u> (of chlorophyll) ;</li> <li>8 produces (free) electrons ;</li> <li>9 (for) <u>photophosphorylation</u> ;</li> <li>10 <math>\text{ADP} \rightarrow \text{ATP}</math> ;</li> <li>11 photolysis / splitting of water molecule ;</li> <li>12 into hydrogen / protons <b>and</b> oxygen ;</li> <li>13 oxygen is a <u>waste product</u> ;</li> <li>14 hydrogen combines with (carrier molecule) NADP ;</li> <li>15 to form reduced NADP / NADPH ;</li> <li>16 ATP and reduced NADP are passed to the light-independent stage ;</li> <li>17 where they are an <u>energy source</u> ;</li> </ol> | 10    |

**PUBLISHED**

| Question | Answer  | Marks    |
|----------|---|----------|
| 6(a)     | <p><i>any 6 of:</i></p> <ol style="list-style-type: none"> <li>1 introduce legislation (locally and globally) ;</li> <li>2 help to secure international cooperation ;</li> <li>3 protects whale stocks ;</li> <li>4 whaling can be banned altogether ;</li> <li>5 e.g. Southern Ocean Sanctuary ;</li> <li>6 or managed by having, quotas / seasons ;</li> <li>7 not always successful / not all countries sign up ;</li> <li>8 idea that funding provided for conservation ;</li> <li>9 does not apply if whale is killed for research ;</li> <li>10 enforcement / monitoring, difficult to apply ;</li> </ol> | <b>6</b> |

| Question | Answer  | Marks |
|----------|---|-------|
| 6(b)     | <p>any 7 of:</p> <ol style="list-style-type: none"> <li>1 sharks <b>and</b> whales carry out internal fertilisation ;</li> <li>2 males introduce sperm into the female's body ;</li> <li>3 via claspers in sharks and penis in whales ;</li> <li>4. fewer sperm are produced than if fertilisation was external ;</li> <li>5 as fertilisation is more guaranteed ;</li> <li>6 both are <i>K</i>-strategists ;</li> <li>7 whale young are fed via placenta ;</li> <li>8 shark eggs fed, via yolk sac / via placenta ;</li> <li>9 sharks have a few offspring, whales have only one calf ;</li> <li>10 whales and (some) sharks give birth to live young / viviparous ;</li> <li>11 some sharks give birth to live young inside a mermaid's purse ;</li> <li>12 shark young are independent straight away ;</li> <li>13 young whales fed on milk ;</li> <li>14 whale calf remains with mother until sexually mature / for many years ;</li> <li>15 whale pod protect calf from predators / calf learns from parent ;</li> </ol> | 7     |

| Question | Answer  | Marks |
|----------|---|-------|
| 7        | <p>any 7 of:</p> <ol style="list-style-type: none"> <li>tropical / subtropical, climate / temperatures ;</li> <li>coastal region / estuary ;</li> <li>(inter)tidal / littoral zone ;</li> <li>sheltered / shallow areas ;</li> <li>(high levels of) sediment / nutrients ;</li> <li>(prop roots) form nursery areas / habitat, for, fish / invertebrates ;</li> <li>so increase in mangroves increases, fish / invertebrate <u>numbers</u> ;</li> <li>more fish / invertebrates, to <u>migrate</u> into surrounding water ;</li> <li>increases, variety of species / catch, for fishermen ;</li> <li>so more employment as, fishermen / fish processors ;</li> <li>idea of more fish, to sell / increases income ;</li> <li>prop roots trap sediment ;</li> <li>prevents build up on fishing areas e.g. coral reefs / seagrass beds ;</li> <li>correct ref to aquaculture around mangroves ;</li> </ol> | 7     |