



## Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/33**

Paper 3 A Level Theory

**May/June 2022**

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 2022 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 **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 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  
 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).

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- This mark scheme will use the following abbreviations:
  - ; separates marking points
  - / separates alternatives within a marking point
  - ( ) contents of brackets are not required but should be implied / the contents set the context of the answer
  - R reject
  - A accept (answers that are correctly cued by the question or guidance you have received)
  - I ignore (mark as if this material was not present)
  - AW alternative wording (where responses vary more than usual, accept other ways of expressing the same idea)
  - AVP alternative valid point (where a greater than usual variety of responses is expected)
  - ORA or reverse argument
  - underline 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)

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Question	Answer	Marks
1(a)	cell wall ; large <u>permanent</u> vacuole ; chloroplasts ;	<b>3</b>
1(a)(ii)	<b>A</b> – cell membrane <b>B</b> – <u>rough</u> endoplasmic reticulum <b>C</b> – mitochondrion <b>D</b> – <u>smooth</u> endoplasmic reticulum ; ; ;	<b>3</b>
1(a)(iii)	<b>E</b> (Golgi apparatus) collects and processes molecules / makes glycoproteins / makes glycolipids / makes lysosomes ; <b>F</b> (ribosome) protein synthesis ; <b>G</b> (nucleus) contains chromosomes / DNA / hereditary material, which determine protein structure ;	<b>3</b>
1(b)	forms a bilayer ; heads on outside <b>and</b> tails in inside ; hydrophobic / non-polar tails <b>and</b> hydrophilic / polar heads ;	<b>3</b>

Question	Answer	Marks
2(a)(i)	light-independent stage / Calvin cycle ; stroma ;	<b>2</b>
2(a)(ii)	<b>A</b> rubisco ; <b>B</b> reduced NADP / NADPH ; <b>C</b> ATP ; <b>D</b> glucose ;	<b>4</b>
2(b)(i)	<i>any 3 from:</i> rate (of photosynthesis) increases with increasing temperature ; as particles have more (kinetic) energy ; rate decreases, after optimum / when temperature increases further ; as solubility of gases decreases ;	<b>3</b>

Question	Answer	Marks
2(b)(ii)		1
2(b)(iii)	carbon dioxide is a limiting factor for photosynthesis <b>or</b> increasing carbon dioxide increases rate of photosynthesis ;	1

Question	Answer	Marks
3(a)(i)	<p>more oxygen available in sub-tropical waters, <b>and</b> more respiration / more energy available, (for growth) ;</p> <p><b>or</b></p> <p>more nutrients available / increased upwelling in sub-tropical areas, <b>and</b> more primary productivity / more food (for growth) ;</p> <p><b>or</b></p> <p>more food available in sub-tropical areas, <b>and</b> less competition for food ;</p> <p><b>or</b></p> <p><b>AVP</b> ;</p>	1
3(a)(ii)	<p><i>any 4 from:</i></p> <p>change in gear from longline and pole and line to purse seine ; purse seine can catch whole shoals at once ;</p> <p>use of sonar to detect, size / depth / location, of shoal ; increase in number / size of fishing areas (further from coast) ; advantage of using industrial boats ;</p> <p>use of FADs (has increased mean catch) ; FADs increase percentage of skipjack tuna in catch ; by (approximately) <math>\times 6</math> ;</p>	4



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)(iii)	idea that if, current catch levels continue / fishing levels are above MSY, there will be no fish left to breed in future ;	<b>1</b>
3(a)(iv)	<i>any 2 of:</i> increase size of mesh ; reduce size of nets ; replace purse seine fishing with pole and line fishing ;	<b>2</b>
3(b)	<i>any 4 of:</i> no specific breeding grounds ; breed throughout the year ; so difficult to monitor breeding / recruitment ; logbooks / data, showing fish catch not completed / incomplete / completed dishonestly ; to reduce the chance of restrictions being introduced / to avoid fines / avoid fishing above quotas ; by-catch / undersized / juvenile / damaged tuna, could be thrown back into the sea / not reported ; lack of observers to monitor catch ; no technology on boats to report catch ; too few fish have been tagged ; little / no data on natural mortality ; <b>AVP</b> ;	<b>4</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)	<i>any 2 from:</i> demand for energy is increasing ; it is, renewable / sustainable, energy source / it does not use fossil fuels ; no / less carbon dioxide released into the atmosphere / reduced carbon footprint ; so less effect on global warming ; idea of legislation to decrease carbon dioxide emissions ;	<b>2</b>

Question	Answer	Marks
4(b)	<p><i>any 3 from:</i>            loss of, feeding / breeding / nursery area, reduces fish numbers ;            electromagnetic field (from cables) / loud noise from, drilling / hammering, drives, fish / prey species, away ;            loud noise / drilling / vibrations, can damage, fish, eggs / larvae / cause fish to migrate ;            fish migration routes might change ;            increase in sediment / turbidity (from construction) + suitable effect on marine species ;            sediment / construction materials, might release toxins, killing fish ;            laying cables / steel tubes / drilling, destroys benthic habitat / dislodges benthic organisms ;  <b>AVP</b> ;</p>	<b>3</b>
4(c)	<p><i>any 3 from:</i>            larger surface area for attachment of organisms ;            more habitat available for organisms / acts as an artificial reef ;            (holes) provide more hiding places for prey / more breeding areas ;            reef balls / holes, will dissipate energy in currents ;            causing less erosion ;            more biodiversity (over time) ;            quarrying of large rocks causes ecological damage ;</p>	<b>3</b>
4(d)	<p><i>advantage</i>            provide a refuge for fish to breed ;  <b>or</b>            can act as fish aggregation devices ;  <b>or</b>            can increase fish numbers in surrounding areas ;</p> <p><i>disadvantage</i>            loss of fishing areas ;  <b>or</b>            increases competition for fish (in a smaller fishing area) ;  <b>or</b>            cables can damage benthic trawls / rocks can damage nets / vibrations from wind farms cause fish migration away from area ;  <b>or</b>            increased fuel costs / difficulty navigating around wind farm ;</p>	<b>2</b>

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Question	Answer	Marks
5	<p><b>MAX 6 from:</b> <i>benefits</i></p> <ol style="list-style-type: none"> <li>1 more temperature stable than coastal water ;</li> <li>2 no chance of any pollution from cage escaping (as waste removed) ;</li> <li>3 little effect on local biodiversity ;</li> <li>4 no / less chance of predation / parasites ;</li> <li>5 no / less chance of fish escape ;</li> <li>6 no chance of disease spreading to cage from wild populations ;</li> <li>7 less habitat damage from anchors, as cages visited less often ;</li> <li>8 can be lowered in adverse weather so reducing the chance of damage to cages ;</li> <li>9 no chance of being affected by algal blooms from sea ;</li> <li>10 less chance of being affected by pollutants in water outside the cage ;</li> <li>11 (fully monitored from land) less visits to cages so less fuels used ;</li> <li>12 <b>AVP</b> ; ;</li> </ol> <p><b>MAX 6 from:</b> <i>challenges</i></p> <ol style="list-style-type: none"> <li>1 increased expense of setting up the system in, deep water / open ocean ;</li> <li>2 increased, running / maintenance / energy, costs ;</li> <li>3 extra distance to, check cages / carry out maintenance / harvest fish ;</li> <li>4 might not be possible to reach cages in adverse weather ;</li> <li>5 increased chance of adverse weather, so more prone to cage damage / fish escape ;</li> <li>6 cages need to be more robust to combat adverse weather ;</li> <li>7 winch / anchor needs to be strong enough to hold cage in place in strong currents / adverse weather ;</li> <li>8 dependent on power / food supply / monitoring from land ;</li> <li>9 waste products need to be processed on land ;</li> <li>10 tubes on sea floor could, damage habitat for benthic organisms / entangle marine animals ;</li> <li>11 need a beacon / light needs to be on constantly, to show position of cages to avoid damage by shipping ;</li> <li>12 <b>AVP</b> ; ;</li> </ol>	<b>10</b>

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Question	Answer	Marks
6(a)	<p><i>any 6 from:</i></p> <ol style="list-style-type: none"> <li>1 solar / electromagnetic radiation passes through Earth's atmosphere ;</li> <li>2 short wavelength ;</li> <li>3 is absorbed by Earth's surface ;</li> <li>4 some is reflected back ;</li> <li>5 as infra-red radiation / radiation of longer wavelengths ;</li> <li>6 and warms atmosphere / Earth's surface ;</li> <li>7 as it is trapped by greenhouse gases ;</li> <li>8 suitable example of a greenhouse gas ;</li> <li>9 which maintains a higher temperature (than without the greenhouse effect) ;</li> </ol>	<b>6</b>
6(b)	<p><i>any 8 from:</i></p> <ol style="list-style-type: none"> <li>1 causes coral bleaching ;</li> <li>2 as zooxanthellae are expelled ;</li> <li>3 so cannot photosynthesise / so reduced food for coral ;</li> <li>4 causes changes to the number / distribution of species ;</li> <li>5 (due to) migration to more suitable / cooler areas ;</li> <li>6 can result in, competition with new species / invasive species ;</li> <li>7 can cause food sources to become, scarce / die out ;</li> <li>8 reproductive rates are usually lower in warmer water ;</li> <li>9 less oxygen for respiration in warmer water ;</li> <li>10 can increase (phytoplankton) productivity ;</li> <li>11 as enzymes are more active / more photosynthesis ;</li> <li>12 can result in harmful algal blooms ;</li> <li>13 increased evaporation causes an increase in salinity ;</li> <li>14 which can affect osmosis / water potentials in cells ;</li> <li>15 increasing temperatures can cause changes to ocean currents ;</li> <li>16 melting sea ice + suitable effect;</li> </ol>	<b>8</b>

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Question	Answer	Marks
7	<p><i>any 6 from:</i></p> <ol style="list-style-type: none"> <li>1 maintains stable ecosystems ;</li> <li>2 mangroves / coral reefs, protect coastlines from flooding / erosion <b>or</b> act as nurseries for many species ;</li> <li>3 prevents extinction of species ;</li> <li>4 extinction of (keystone) species can, alter / disrupt, food chains / webs ;</li> <li>5 as it affects balance of predators and prey ;</li> <li>6 some species depend on others for distribution ;</li> <li>7 some species (e.g. corals) are an important source of medicines ;</li> <li>8 ensures a food supply (for future generations) ;</li> <li>9 preserves genetic diversity ;</li> <li>10 important for tourism / fishing industry ;</li> <li>11 so generates income / employment ;</li> <li>12 producers absorb CO<sub>2</sub>, so act as carbon sinks / help in climate control ;</li> <li>13 <b>AVP</b> ;</li> </ol>	<b>6</b>