



## Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/03**

Paper 3 A2 Structured Questions

**October/November 2021**

**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 2021 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 **11** 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.

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)

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(i)	open ocean ;	<b>1</b>
1(a)(ii)	<u>circular</u> water currents / gyre, prevent <i>Sargassum</i> from leaving ;	<b>1</b>
1(a)(iii)	<p><b>any 2 of:</b>            (photosynthesis) produces oxygen for consumer respiration ;  <u>decomposition</u> provides a source of nutrients / mineral salts in the ocean ;            dense mats slow down the current so preventing small organisms from being washed away ;            acts as a carbon sink ;</p>	<b>2</b>
1(b)(i)	<p><b>any 2 pairs of:</b>            point X is closer to the equator ;  <b>or</b>            water is warmer close to the coast (compared with open ocean) ;            so enzymes for photosynthesis work faster / increases rate of photosynthesis ;</p> <p>light intensity is greater at the equator ;            so rate of photosynthesis / productivity increases ;</p> <p>more upwelling / nutrients in coastal waters ;            so more nitrogen / nitrates for growth / protein ;</p>	<b>4</b>
1(b)(ii)	<p><b>any 2 of:</b>            adult turtles cannot swim through the <i>Sargassum</i>, to get to beaches to nest ;            entanglement causes them to, drown / starve / be unable to get air / suffocate ;  <i>Sargassum</i> prevents adult turtle from digging a nest in the sand ;            hatchlings unable to dig their way out from nest through the <i>Sargassum</i> ;</p>	<b>2</b>

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Question	Answer	Marks
2(a)	<i>any 3 of:</i> fish swim with mouth open ; water <u>forced</u> over gills ; ref. to <u>constant</u> flow of water ; water (forced) out through operculum / gill slits ; ref to fish swimming constantly ;	<b>3</b>
2(b)	<i>any 3 of:</i> mouth closes <b>AND</b> operculum opens ; volume of buccal cavity is reduced ; ref. to contraction and relaxation of muscles ; pressure inside buccal cavity increases / greater than external pressure (allowing outflow of water) ;	<b>3</b>
2(c)	<i>any 2 of:</i> rest during the day / do not move continuously ; so little, muscle movement / contraction ; slow-moving, so less energy / oxygen requirement ;	<b>2</b>

Question	Answer	Marks
3(a)(i)	whales internal <b>AND</b> tuna external (fertilisation) ;	<b>1</b>
3(a)(ii)	<i>any 1 of:</i> mass spawning / millions of gametes are released <u>at the same time</u> ; large numbers of sexually mature adults gather at spawning ground / in same place / at same time ;	<b>1</b>
3(a)(iii)	<i>any 2 of:</i> provide parental care / are <i>k-strategists</i> , so protect young from predators ; feeds young on milk after birth so ensures food supply available for many months ; offspring develops inside mother, so fed / protected before birth ; only one calf born, so only one to feed / protect ; calves remain with mother/family group, so protected for many years ;	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(b)(i)	<p><i>any 2 of:</i>  length of time as a juvenile / adult before breeding starts ;  breeding can only occur every 3 to 6 years ;  many travel alone, so cannot hear mating call ;  pairs do not stay together ;</p>	<b>2</b>
3(b)(ii)	<p><i>any 2 of:</i>  both occur on whale migration routes / feeding / breeding areas ;  whale gets trapped in fishing gear and cannot feed / breathe / dies ;  whale is damaged / killed by ship collisions ;  sound pollution from shipping prevents whale communication ;  fishing reduces food supply for whales ;</p>	<b>2</b>
3(c)	<p><i>any 3 of:</i>  slower speed means less collisions with whales ;  ropeless traps means less chance of whale entanglement ;  so more survive to breed ;  shipping could cost more as it takes longer to get to port ;  fishermen could lose money as the season / fishing area is reduced / cost of new traps ;  restrictions on fishing increases food supply for whale ;</p>	<b>3</b>
3(d)	<p><i>any 2 of:</i> covers a much larger area ;  (more) accurate identification of species / accurate numbers ;  can monitor numbers continuously ;  saves fuel costs for planes / boats ;  does not disturb whales ;</p>	<b>2</b>
3(e)	<p><i>any 2 of:</i>  sonar adds extra sound into the sea, so whales cannot hear each other ;  unable to hear warning sounds from other whales ;  female unable to hear mating calls of male ;  sonar drives female whales away from breeding area ;</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(f)	<i>any 1 of:</i> breeding only takes place every 3 to 6 years ; no breeding until 9–10 years ; age of the whales unknown, they might be juveniles ; other factors / lack of food could influence breeding ;	<b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)	<i>any 2 of:</i> recruitment ; growth ; fecundity ; dependency on particular habitats ;	<b>2</b>
4(b)(i)	fishing that does not reduce future numbers of fish / recruitment is higher than mortality / fishing below the maximum sustainable yield ;	<b>1</b>
4(b)(ii)	catch increased / (too high in 2015 and 2018), so population cannot recover ;	<b>1</b>
4(b)(iii)	<i>any 2 of:</i> restriction of catch by season ; restriction by location ; restrictions by quotas ; restriction on mesh size / compulsory use of rod and line ; restriction on fish size that can be retained ; restriction on fishing intensity ;	<b>2</b>
4(c)(i)	tuna swim in surface waters / mid-water / pelagic zone ; benthic trawling is used for bottom dwelling fish ;	<b>2</b>



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(c)(ii)	<p><i>any 2 pairs of:</i>            93% / over 90% / most albacore fishing is by <b>longline</b>, (but only 13% of yellowfin) ;            suggests that this is a sustainable method of fishing / albacore stocks are good ;</p> <p>32% / most yellowfin are caught by <b>purse seine fishing</b>, (but only 5% albacore) ;            purse seine fishing catches entire shoals, which is, unsustainable / why yellowfin stocks are declining ;</p> <p><b>pole and line</b> is a sustainable fishing method, but it only represents 3% of yellowfin fishing ;            so has little impact on conserving stocks ;</p> <p>16% of yellowfin is caught by <b>gillnet</b>, (gillnets not used for Albacore tuna) ;            fishing using gillnets catches all fish regardless of size, so is not sustainable / yellowfin stocks are in decline ;</p>	<b>4</b>
4(d)	<p>(idea of) interdependence of organisms in an ecosystem / habitat ;            (idea of) loss of one species / conserving too many of one species causes imbalance (in food chains and food webs) ;            (idea that) biological processes in ecosystems recycle materials for re-use by successive generations ;</p>	<b>3</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(i)	<p><i>any 1 of:</i>            fish enclosed in net cage ;            fish are fed ;            high stocking density ;</p>	<b>1</b>
5(a)(ii)	<p><i>any 1 of:</i>            no control over temperature / pH / oxygen ;            waste material swept away by current ;</p>	<b>1</b>
5(a)(iii)	prevents fish escaping / birds eating fish ;	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(iv)	fish are stressed / close together ; so more chance of disease / more chance of spreading disease; <b>or</b> some fish might not have enough food ; so will be smaller than others / will result in size variations ; <b>or</b> build-up of toxic waste products inside the cage ; could kill fish / results in smaller harvest ;	<b>2</b>
5(a)(v)	fish need oxygen to carry out <u>respiration</u> ;	<b>1</b>
5(a)(vi)	<i>any 3 of:</i> waste food / faeces from fish fall below cage ; broken down / decomposed by bacteria ; which use up oxygen (during respiration) ; reduced light intensity at depth, so less / no photosynthesis (to produce oxygen) ;	<b>3</b>
5(b)(i)	<i>any 2 of:</i> sediment collection can take place without the need for divers ; less disruptive to the organisms living in the sediment ; better representation of organisms present ; saves time sorting and identifying organisms ; finding an expert to identify species might be difficult ;	<b>2</b>
5(b)(ii)	<i>any 1 of:</i> relies on computer analysis and <u>prediction</u> which might not be as accurate as counting actual specimens ; fragments of eDNA could have come from the same organism ; eDNA may have come from elsewhere ;	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)(i)	<p><i>any 3 of:</i>  allows more oysters to breed ;  allows fertilised eggs / larvae to spread to other areas, so increasing oyster numbers ;  provides a permanent habitat for other species ;  increasing biodiversity / increasing numbers of other species ;</p>	<b>3</b>
6(a)(ii)	<p><i>any 2 of:</i>  adult oysters breed in hatcheries ;  more offspring survive than in the wild ;  young oysters can be transferred to the bay ;  (idea of) oysters grown and harvested on land would reduce pressure on wild stock ;</p>	<b>2</b>
6(a)(iii)	<p><i>any 2 of:</i>  more likely to accept the programme if they are involved ;  can benefit from income from oysters / improved economy ;  increase in jobs ;  increase in fishing (as sanctuary areas attract fish) ;</p>	<b>2</b>
6(b)(i)	<p><i>any 3 of:</i>  selecting adults for disease resistance ;  breeding from these adults ;  continuous selection over many generations ;  selective breeding is based on whether oyster is disease resistant, not on genes ;</p>	<b>3</b>
6(b)(ii)	a section of DNA which codes for a particular protein / polypeptide ;	<b>1</b>
6(b)(iii)	genes are not transferred from one organism to another / not manipulated ;	<b>1</b>
6(b)(iv)	<p><i>any 2 of:</i>  don't have to expose oysters to disease ;  less time consuming ;  saves keeping oysters in captivity for many years ;  greater chance of genetic diversity / more suited to natural wild conditions ;</p>	<b>2</b>