



Cambridge International AS & A Level

MARINE SCIENCE

9693/04

Paper 4 A2 Data-Handling and Free-Response

October/November 2021

MARK SCHEME

Maximum Mark: 50

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.

This document consists of **9** 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.

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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)	temperature ; as it affects enzyme activity ; OR carbon dioxide concentration ; as it is a raw material for photosynthesis / AW ; OR light intensity / distance of lamp / AW ; as it provides energy for photosynthesis ;	2
1(b)	axes – all correctly labelled including units ; scale – suitable linear scale for each scale using at least half the grid ; plots – $\pm \frac{1}{2}$ small square ; line – straight lines joining points ; key – key or lines labelled ;	5
1(c)	<i>any 4 of:</i> species B lives in deeper water / species A at the surface ; species B has, accessory pigments / named accessory pigment ; to absorb, more green / yellow, light / light wavelengths around 575 nm ; as deeper water has less red light / red does not penetrate far / AW ; species A has a faster rate of photosynthesis with red / blue light ; accessory pigments must reduce efficiency at the surface / accessory pigments must have a cost for algae at surface ;	4

Question	Answer	Marks
2(a)(i)	340 ;;	2
2(a)(ii)	<i>any 2 of:</i> with no TBT, more larvae of species A develop normally / AW ; the number of larvae of species A that develop normally decreases steadily / constant decrease / AW ; the number of larvae of species B that develop normally remains constant until 0.62 ($\mu\text{g dm}^{-3}$) and then decreases (sharply) / AW ; more larvae of species A develop normally with concentrations lower than 0.28 / higher than 0.8 / more larvae of species B develop normally with concentrations between 0.28 and 0.80 ;	2

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Question	Answer	Marks
2(b)	<p><i>any 5 of:</i> (independent variable) tannin and no tannin / range of concentrations of tannin ; (dependent variable) measure area of material covered with barnacles / count barnacles / AW ; barnacle larvae of same number / age / species added ; leave for stated time ; one abiotic control, e.g. salinity, oxygen, temperature, light, feeding of barnacles, type of material used / size of metal plate ; repeat and calculate mean ;</p>	5

Question	Answer	Marks
3(a)(i)	<p><i>max 3 of:</i> larger organisms have a lower surface area : volume ratio / AW ; more spherical organisms / AW have a lower surface area : volume ratio ; larger organisms have an increased diffusion distance / takes longer for diffusion / have insufficient surface area for diffusion alone / AW ;</p> <p><i>max 3 of:</i> oxygen is required for respiration ; larger organisms often have higher oxygen demand, due to having more cells / tissues ; gills have, (lamellae / filaments) to provide large surface area ; coral have projections of body surface to provide large surface area ;</p>	4
3(a)(ii)	<p><i>any 4 of:</i> whale has a double circulatory system / fish has a single circulatory system / AW ; oxygen is absorbed in gills / lungs, and transported to muscles ; whale requires faster transport of blood / oxygen / blood has higher blood pressure / AW ; (oxygen) for <u>respiration</u> in muscle cells ; to release energy faster in muscles ; so whale can contract muscles more / whales are more active / AW ;</p>	4

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Question	Answer	Marks
3(b)	<p><i>any 7 of:</i> adults are anchored to seabed / substrate ; in colonies / beds / groups, to help reproduction ; release sperm and eggs / gametes, into water / broadcast spawning / external fertilisation occurs ; fertilisation is random increasing genetic variation ; (embryo) develops into trochophore larva ; free swimming larvae in planktonic layer ; maximises food availability / can have different food compared with adults ; different niche allows oysters to be distributed ; (trochophore) develops into veliger larvae ; (veliger) grows foot / becomes pediveliger ; settles down to form a spat / attaches onto seabed / substrate, to grow ; suitable area for filter feeding / stops being washed away ; mature after 2 years ; firstly into males and later females ;</p>	7

Question	Answer	Marks
4(a)	<p><i>any 5 of:</i> (restrictions = accept converse for unrestricted fishing) cause short term unemployment ; cause short term conflict with fishers ; lead to loss of revenue and hardship / loss of boats / gear / damage to local economy / AW ; lead to illegal fishing ; enable sustainable fishing in long term / long term employment / AW ; preserves food chains for other species that are caught ; allows opportunity to diversify economy / move to other industries e.g. tourism ; compensation given to fishers for loss of income ;</p>	5
4(b)	<p><i>any 4 of:</i> fewer cars / use electric cars / more bicycles / less use of electricity / air conditioning / AW ; more use of named renewable energy sources ; e.g. solar power less use of fossil fuel so less carbon dioxide release ; reduced global warming / reduced enhanced greenhouse effect / reduced ocean acidification / reduced climate change ; maintains biodiversity / reduced extinction / reduced reef erosion / reduced ice sheet melting / AW ;</p>	4

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Question	Answer	Marks
4(c)	<i>any 6 of:</i> destruction of habitat / damage to benthic species ; release of metal ions / toxins / metal ions bioaccumulate / AW ; release of sediment increasing turbidity / reducing light penetration ; reducing photosynthesis / primary productivity ; (sediment) damaging filter feeders / gills ; less energy / biomass to pass along food, chains / webs ; release of organic waste / nutrients, causing increased decomposition / leading to eutrophication / algal blooms ; (bacterial respiration) reducing oxygen concentrations ; animal species die due to lack of oxygen for respiration ;	6