Cambridge Assessment International Education

Cambridge International AS & A Level

MARINE SCIENCE **9693/04**

Paper 4 A2 Data Handling and Free-Response **May/June 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 May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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	<u>'List rule' guidance</u> 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	<u>Calculation specific guidance</u> 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	<u>Guidance for chemical equations</u> 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)

Question	Answer	Marks
1(a)(i)	(–)3.125 / –3 / –3.1 / –3.13 ;;	**2**
1(a)(ii)	A1 (axis) – label one *y*-axis as percentage cover (with living) coral (and year) A2 (axis) – label one *y*-axis as (mean annual global release) of carbon dioxide / million tonnes (and year) S (scale) – suitable linear scale for both *y*-axis scales with at least one line over half grid ; P (plot) $\pm\frac{1}{2}$ small square ; L (line) – straight lines joining points with no extrapolation ; K (key) – key or line labelled ;	**6**
1(b)	**1** idea of (negative) correlation between percentage cover with coral and CO_2 release ; *any **3** of:* **2** CO_2 is a greenhouse gas / traps heat / causes enhanced greenhouse effect / **AW** ; **3** data is for CO_2 release, not global temperature ; **4** correlation does not mean causation / **AW** ; **5** other (named) factors (other than carbon dioxide related factors) may have affected (this area of ocean) ; **6** only one, ocean / area, has been investigated / no repeats / only one set of data shown / not a long enough period / **AW** ; **7** acidification / reduction in pH may have caused coral loss (rather than temperature) ;	**4**

Question	Answer	Marks
2(a)(i)	500(%) ;;	**2**
2(a)(ii)	*any **2** of:* increasing mass of fertiliser increases (percentage) reduction of oil (up to 60 g) ; percentage reduction decreases after 60 g / decreases at 90 g ; no (significant) difference between 30 g and 60 g / reference to overlap of error bars / standard deviation / no real difference / **AW** ;	**2**

Question	Answer	Marks
2(b)	*any **4** of:* **1** (30 g) increases removal of oil (compared to no fertilizer) ; **2** (increasing amounts of fertiliser) increases alga growth / algal blooms / eutrophication / less of algal growth (than at high amounts) ; **3** (eutrophication leads to) decomposition / (increased) bacteria respiration ; **4** loss of oxygen / toxins (from algae) / dead zones ; **5** increasing fertiliser, beyond 30 g / after 60 g, makes little difference (to oil digestion) / causes a decrease at 90 g; **6** correct ref to error bars / standard deviations ; **7** using extra fertiliser is not cost effective / wastes money ;	4

Question	Answer	Marks
3(a)(i)	*any **3** of:* **1** air bladders to float (fronds) / hold upright / **AW** ; **2** (thallus) is flat / flattened for large surface area ; **3** (air bladders / flat) to maximise exposure / to absorb light / for photosynthesis ; **4** pieces can break away and float ; **5** thallus is flexible to prevent, breakage / damage, by currents / storms / wave action ; **6** can have a holdfast to anchor / attach to substrate / prevent being washed away / **AW** ;	3
3(a)(ii)	*any **6** of:* **1** (loss) would reduce energy / food, for food, webs / chains, for other organisms / **AW** / **ORA** ; **2** reduced biodiversity / **ORA** ; **3** destabilises sea bed / increased erosion / **ORA** ; **4** increases turbidity / cloudiness / **ORA** ; **5** (loss) leads to less photosynthesis / less primary productivity / **ORA** ; **6** leading to reduced oxygen in the water / increased carbon dioxide / **ORA** ; **7** less respiration by other organisms / **ORA** ; **8** loss of habitats / **ORA** ; **9** (loss) reduces areas for, egg laying / nursey sites / breeding sites / less reproduction / **AW** / **ORA** ; **10** loss of protection from predators / shelters / **AW** / **ORA** ; **11** increased wave energy / water currents / **AW** / **ORA** ;	6

Question	Answer	Marks
3(b)	*any **6** of:* **1** tuna use external fertilisation / whales use internal fertilisation / **AW** ; **2** tuna eggs less likely to be fertilised / whale eggs more likely to be fertilised / **AW** ; **3** tuna uses random fertilisation / whales select mate / **AW** ; **4** tuna leads to increased genetic variation / whales have less genetic variation / **AW** ; **5** tuna have, external development / larval stage / whales use, internal development / no larval stage ; **6** tuna has no parental care / whales have parental care ; **7** tuna offspring have low survival rate / whales offspring have higher survival rate ; **8** tuna produce high numbers of offspring / whales produce few offspring ; **9** tuna breed annually / whale breed every 2–5 years ;	**6**

Question	Answer	Marks
4(a)(i)	*any **3** of:* **1** conservation, increases / maintains, the population of an organism ; **2** must have enough food / prey / producers / named food ; **3** must have, predators / named example / competitors (to keep it from over reproducing) / not too many predators present / **AW** ; **4** population of (conserved) organisms must not become too high / must be managed / stop it over reproducing / **AW** ; **5** reference to harmful effect on ecosystem / food web / habitat / other species ;	**3**

Question	Answer	Marks
4(a)(ii)	***any 4 of:*** **1** (primary) productivity / energy for food chains / webs ; **2** more sustainable catches / ensure catches for future / maintain <u>long-term</u> populations ; **3** removal of mineral ions / run off from agriculture / less risk of eutrophication ; **4** nursery site / shelter / protection / breeding grounds ; **5** reduce coastal erosion / stabilise substrate / protect against storms ; **6** increase biodiversity ; **7** improves local economy / employment / increased revenue from fish catch ; ***and MAX four of:*** **8** can overgrow, push out other species / become invasive / damage existing food webs / competition for, nutrients / light, with other producers / **AW** ; **9** can lead to increased decomposition / (decay causes) oxygen loss ; **10** causes conflict with people, e.g. loss of fishing sites / aquaculture / loss of tourism / beach development / other land use conflict ; **11** replanting mangroves is expensive / labour intensive / **AW** ; **12** mangroves take a long time to grow / rehabilitate / **AW** ;	**5**
4(b)	*any **7** of:* **1** low stocking density / **AW** ; **2** control feeding / feed little and often / **AW** ; **3** idea of multitrophic aquaculture / place plants in area / **AW** ; **4** (multitrophic aquaculture) removes waste food / faeces / remove minerals / recycled between organisms ; **5** reduce decomposition of, faeces / waste food ; **6** less oxygen loss / algal blooms / eutrophication ; **7** (low stocking density / controlled feeding / multi trophic) reduce disease spread ; **8** minimise use of antibiotics / pesticides ; **9** use biological control to remove pests ; **10** to stop (antibiotic / pesticide) resistance / reduce bioaccumulation ; **11** use nets / cages / **AW**, to prevent escape ; **12** reducing breeding with wild populations / damage to food webs / competition with wild fish / spread of genes / affect gene pool / **AW** ; **13** use plant based food / fish offcuts (to reduce catching wild fish) / minimise catching wild fish for feed / minimise use of wild broodstock / **AW** ; **14** site away from environmentally sensitive areas / site near strong water currents / minimise motorised transport / **AW** ;	**7**