MARINE SCIENCE **9693/22**

Paper 2 AS Data Handling and Free-Response **May/June 2021**

MARK SCHEME

Maximum Mark: 50

Published

This document consists of **10** printed pages.

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)

Question	Answer	Marks
1(a)	one lionfish present causes (large) decrease in juvenile fish number ; decreases by 90% (after 6 weeks) ; one red grouper present causes (large) increase in juvenile fish number ; increases by 110% (after 6 weeks) ;	4
1(b)	*Yes because…* presence of red grouper seems to reduce impact of Lionfish (predation) on juvenile fish ; presence of red grouper may also deter other predators of juvenile fish :	1
1(c)(i)	Axes: labels correct for both axes ; Scale : y axis allows bars to cover at least half of grid ; Bars: correctly plotted ±1 / 2 small square ; Bars: equal in width and not touching ;	4
1(c)(ii)	generalist / generalised niche ;	1
1(d)	*any 3 from:* supports idea as more juvenile fish present ; idea not supported by decrease in shrimp species ; no information on, other invertebrates / other predators ; no information on relative abundance ; only one study ; results may be different in other habitats ;	3

Question	Answer	Marks
2(a)	*any 5 from:* *(independent variable)* description of changing light intensity ; range of three or more light intensity values ; *(dependent variable)* measuring dinoflagellate numbers near surface ; *(control variables)* any **2** from: water temperature / water salinity / water pH / nutrient content of water / volume of water / same species / initial distribution or concentration of dinoflagellates ; ; leave for suitable amount of time (at least one hour up to 48 hours) ; tanks of seawater containing dinoflagellates ; idea of repeats ; calculate mean ;	**5**
2(b)	*any 2 from:* idea of increased, light intensity / availability of light ; increase their <u>rate</u> of photosynthesis near surface ; increased productivity / biomass production ; allows for increased rate of reproduction ; ref. to increased access to carbon dioxide near surface ;	**2**

Question	Answer	Marks
3(a)	*any 3 from:* warm water temperature ; suitable depth / within 20 m of surface ; suitable substrate for attachment of coral larvae ; high / sufficient, light intensity ; ref. to clarity / turbidity of water ; suitable pH ;	**3**

Question	Answer	Marks
3(b)	*any 5 from:* geomorphological analysis ; drilling for cores of reef substrate ; from different depths in reef ; analysis of / studying bands in core samples ; (idea of) radiocarbon / ^{14}C dating ; ref. to ^{14}C incorporated into carbonate ; ref. to half life / decay of ^{14}C ; ref. to ratio of ^{14}C to ^{12}C indicates age of coral ;	5
3(c)	*any 7 from:* (coral reefs) absorb wave <u>energy</u> / dissipate wave <u>energy</u> ; reefs reduce wave action / reduce size or strength of waves / slow down waves ; increased erosion of shores **AW** ; reduced protection for coastal properties ; reduced protection of coastal anchorages / boats ; reduced protection of ecosystems ; reduced tourism; reduced, food from, (harvesting / fishing) ; reduced income / profit ; reduced protection from extreme weather effects e.g. cyclones / hurricanes ; cost of building breakwaters / sea walls ; **AVP** ;	7

Question	Answer	Marks
4(a)	*any 3 from:* between mid-ocean ridges and continental rise ; upwards movement of molten material / magma ; which solidifies and forms new ocean crust ; ref. mantle convection ; uneven rock surface becomes covered by sediments from above ;	3

Question	Answer	Marks
4(b)(i)	*any 4 from:* absence of light (on deep ocean floor) ; absence of photosynthetic organisms ; lack of primary productivity / synthesis of organic molecules by producers ; cold temperatures ; limited input from chemosynthesis ;	**4**
4(b)(ii)	*any 8 from:* (source of) nitrogen ; required for protein synthesis / amino acids / DNA / RNA / ATP ; (source of) calcium ; required for bones / shells ; (source of) phosphorus ; required for bone / DNA / RNA / ATP ; (source of) carbon ; (required for) organic molecules ; (source of) magnesium ; required for chlorophyll / bones ; other correct named example ; other correct use ;	**8**