Cambridge International AS & A Level

MARINE SCIENCE **9693/21**
Paper 2 AS Level Data-Handling and Investigative Skills **October/November 2023**
MARK SCHEME
Maximum Mark: 75

Published

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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.

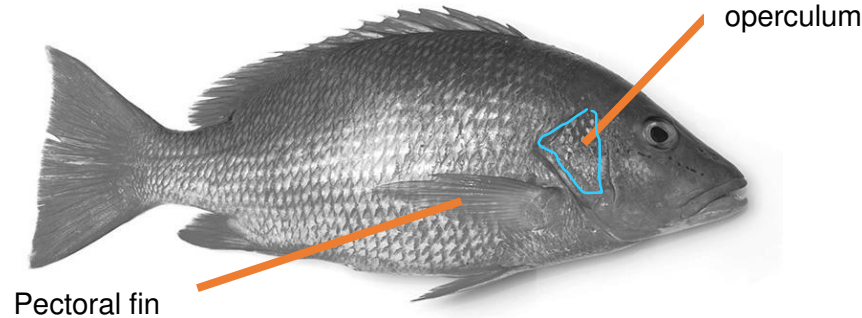| Question	Answer	Marks
1(a)	interactions between, different species / community / biotic factors ; and their (physical), environment / habitat / abiotic factors ;	**2**
1(b)(i)	Bangladesh ;	**1**
1(b)(ii)	correct reading of two figures from graph ; (protected area ÷ total area) × 100 = (value between) 61.34%–70.41% ;	**2**
1(b)(iii)	*any 2 from:* global warming / climate change / temperature change ; over-harvesting / deforestation ; storm damage ; change in land use or named example e.g. shrimp farms ;	**2**
1(c)(i)	carbon dioxide + water → glucose + oxygen ;	**1**
1(c)(ii)	oxygen concentration ;	**1**
1(c)(iii)	*any 2 from:* temperature (of water) / size, mass, length, of algae / salinity / carbon dioxide / water, type or quality / volume of water or water flow or flow rate (through system) / pH / initial oxygen concentration / colour of light or wavelength ;	**1**
1(c)(iv)	lamp / light source, moved different distances (from the apparatus) ;	**1**
1(c)(v)	*any 1 from:* add additional carbon dioxide / remove built up oxygen ; to acclimatise the macroalgae to the conditions before collecting results **OWTTE** ;	**1**

Question	Answer	Marks
1(c)(vi)	both axes labelled with units ; (suitable) linear scale ; points plotted $\pm$ ½ small square with x or dot in circle ; appropriate lines drawn for both sets of data ; key to identify the 2 data sets ;	5
1(c)(vii)	*Any **3** from:* species B closer to the surface / species A, can extend to greater depth ; (as species B), require a higher light intensity to photosynthesise / higher rate of photosynthesis than A at shallow depths / lower rate of photosynthesis than A at lower light intensities **ORA** ; correct ref. to data comparison or manipulation (from their graph) ; the lines cross over at stated light intensity (from their graph) OR the same rate (of photosynthesis) at stated light intensity ; species B may be found at a narrower range of depths / **ORA** ; both species found near the surface / at high light intensities ;	3
1(c)(viii)	no photosynthesis occurring (as no light) ; respiration uses oxygen ;	2

Question	Answer	Marks
2(a)(i)	divide study area into sections / setting up grid (with tapes) ; use random number generator to select co-ordinates ; place quadrat in selected area / description of how to calculate percentage cover of macroalgae ;	**3**
2(a)(ii)	(advantages) *any 1 from:* equal chance of selection ; reduces (researcher) bias ; **PLUS** (disadvantages) *any 1 from:* takes more time (than systematic) ; may not represent entire area ;	**2**
2(b)	the number of crabs present on an area of shore is not affected by the macroalgae cover **OWTTE** ;	**1**

Question	Answer							Marks
2(c)	quadrat number	percentage cover of macroalgae	rank of macroalgae	number of crabs	rank of number of crabs	difference (D)	D^2	**2**
	4	70	6.5	20	7	0.5	0.25	
	5	95	9	25	10	1	1	
	6	45	4	11	4	0	0	
	7	80	8	22	9	1	1	
	8	10	1	2	2	1	1	
	9	70	6.5	19	6	0.5	0.25	
	10	55	5	12	5	0	0	

Question	Answer	Marks
2(d)	$\Sigma D^2 = 12.5$ and $n = 10$; $6 \times 12.5 = 75$ and $10^3 - 10 = 990$; $75 / 990 = 0.0757(57)$ and $1 - 0.0757 = 0.9243$; correct application of 1 or 2 sig figs to calculated answer / 0.92 / 0.9 ;	**4**
2(e)	*any **2** from:* results, show a positive correlation / close to 1 ; null hypothesis is rejected ; correlation does not mean causation ;	**2**

Question	Answer	Marks
3(a)	outline (neat lines, no shading) ; size (larger than the original) ; proportion (operculum positioned at around ⅓ of the body length (not including caudal fin) and correct body shape, pectoral fin reaching to approximately the middle of the body) ; detail (all fins included, eye, mouth, caudal peduncle) ;	**4**

Question	Answer	Marks
3(b)		2
3(c)(i)	*any 4 from:* catch (a selection of the species at the reef) **AND** count / stated number caught **AND** tag (all fish) and release ; return (stated time) later and catch a sample of the species ; count the number of fish tagged **AND** the total caught the second time ; apply the Lincoln index ; **AVP** ;	4

3(c)(ii) — Marks: 1

Date / month	Total number (of red snapper) caught	Number (red snapper) tagged	Number (red snapper) untagged

Question	Answer	Marks
3(c)(iii)	*any 2 from:* competition ; disease / parasites ; predation ; **AVP** ;	**2**
3(d)(i)	*any 3 from:* 5 species of fish / same no. of species / five out of six species / same species richness, in each area; (but there may be) other species affected they did not monitor / data not collected on, all species / species other than fish ; (on the reef area) there is a large increase in numbers, of 2 species / R and T, OR there is a small increase in, 2 species / Q and P, OR a new species / S, is attracted to artificial reef ; (but) there is a reduction in numbers of 1 species / U (in the artificial reef) / (the species that reduced / U) had only a small number of fish in the area with no reef ; no data for the areas before the reef was built ; fish may have, moved / migrated, from the area without a reef to the area of reef ; data only includes species biodiversity / data does not include genetic or environmental biodiversity ; data manipulation ; **AVP** ;	**3**

Question	Answer	Marks
3(d)(ii)	*any **3** from:* reduces storm surges ; as they absorb (some of) the <u>energy</u> (of the waves) ; waves break before the shore ; reduces shoreline erosion ; shore profile may change / sand deposited / deeper substrate ; because currents are lower behind the reef ; protects, seagrass beds / other habitats, between reef and shore ; **AVP** ;	**3**

Question	Answer	Marks
4(a)	*any **2 pairs** from:* freshwater input / reduced salinity ; so coral / polyps not able to survive ; increases turbidity / sediment (caried) in river ; coral / polyps, smothered **or** light intensity too low / prevents photosynthesis (by zooxanthellae) ; temperature change or stated ; may not be suitable range for coral / polyp growth ; (fine) sediment on seabed ; does not allow coral / polyp attachment ; pH of freshwater is closer to 7 / more acidic (than seawater) ; reducing growth of corals / polyps ; named pollution from runoff into river ; may cause eutrophication / toxicity to the corals / polyps ; high current flow rate from river ; may be too fast for corals / polyps to capture food ;	4
4(b)(i)	(temperature) °C **and** (salinity) ppt / % ;	1

Question	Answer	Marks
4(b)(ii)	(low salinity at surface) salinity rapidly increases (over a small depth) / halocline + then remains steady (with increasing depth) ; **PLUS** any **3** from: (because) fresh water enters from the river ; with a low salinity **ORA** ; this causes lower density **ORA** ; so it floats above the sea water **ORA** ; freshwater mixes with sea water ; until 35–36 (ppt) ; over 8–10 m (depth) the water is sea water and it does not mix with the (floating) fresh water	4
4(b)(iii)	any **3** from: (at location A) at the surface / top 4–8 m, dissolved oxygen (concentration) is higher (than B) **ORA** ; (because) fresh water can dissolve more oxygen (than sea water) **ORA** ; (at location B) below 8 m, dissolved oxygen / oxygen concentrations, are similar to location A; (because) mixing has occurred at location A / salinity **and** temperature of both similar below 12 m, so will hold similar dissolved oxygen / oxygen concentrations ;	3

Question	Answer	Marks
4(b)(iv)	*Any 2 from:* fine particulates / silt / sediment, were not able to, cross / mix with, lower, more saline water ; due to density differences in surface water and sea water ; (idea of) sediment deposited further out than the coral reef due to the strong currents from the Amazon river ; (idea of) movement of water keeping sediment in suspension / fine particulates need low flow rate to settle ; (idea of) sediment deposited between the mouth of the river and the coral reef / mangroves caused sediment to deposit in estuary ;	2
4(c)(i)	(mutualism) both benefit ; (symbiosis) different species living in, close contact / long-term association ;	2
4(c)(ii)	*Any 1 from:* less light available for, photosynthesis ; increased turbidity ; salinity too low ; temperature out of range ; (presence of) freshwater ;	1

Question	Answer	Marks
4(c)(iii)	*any 3 from:* use nematocysts ; to catch passing, zooplankton / small fish ; tentacles draw them into mouth ; pass to stomach (for digestion) ;	3