
MARINE SCIENCE

9693/04

Paper 4 A2 Data Handling and Free-Response

May/June 2018

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.

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This document consists of **12** 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.

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	Guidance
1(a)	<p>two separate <u>linear</u> scales for y axes ;</p> <p><u>a</u>ll axes labelled, with units ;</p> <p>plots correct $\pm \frac{1}{2}$ small square ; ;</p> <p>line (straight, joining points) OR bar (bars equal width, equidistant, not touching) ;</p>	5	<p>A two separate graphs or one with two y axes</p> <p>1 mark for chlorophyll and one mark for oxygen data series</p> <p>If only plotted one series, max 3 (MP 2, 3 and 5)</p>
1(b)(i)	<p><i>any two of:</i></p> <p>idea of, more chlorophyll results in more oxygen produced ;</p> <p>because, chlorophyll is needed for <u>photosynthesis</u> / there is more <u>photosynthesis</u> OR <u>photosynthesis</u> releases oxygen ;</p> <p>photosynthesis increases with more light OR more, phytoplankton / algae / plants, when there is more light ;</p>	2	<p>as chlorophyll increases, O₂ increases</p> <p>A chlorophyll, is used / needed, for photosynthesis</p>
1(b)(ii)	<p><i>any two of:</i></p> <p>temperature (changes affect oxygen in water) ;</p> <p>idea of, as ice sheet melts, there is more <u>atmospheric</u> dissolution ;</p> <p>idea of, more oxygen from (increased) turbulence / mixing ;</p> <p>oxygen is more soluble in less saline water ;</p>	2	<p>R oxygen is more soluble in warm water</p> <p>A more oxygen comes from the <u>air</u></p>

Question	Answer	Marks	Guidance
1(c)	<p><i>any two of:</i> (warmer temperature) increases <u>photosynthesis</u> rate / increases <u>primary</u> productivity ;</p> <p>so that more, <u>energy</u> / <u>biomass</u>, is available for higher trophic levels ;</p> <p>ice caps melt earlier / less ice, increasing oxygen for respiration OR more light for photosynthesis ;</p>	2	A increased productivity by plants / producers / algae

Question	Answer	Marks	Guidance
2(a)(i)	0.4 (:1) ; ;	2	<p>A for correct volume (3375 mm³) for one mark OR 1350 divided by their volume</p> <p>A correct answer written in table</p>
2(a)(ii)	<p><i>any three of:</i></p> <p>(a) large(r) animals / cubes, have low(er) surface area : volume ratio ;</p> <p>(b) idea of, large(r) animals / cubes, have a long(er) (diffusion) path ;</p> <p>(c) <u>diffusion</u> of oxygen / carbon dioxide would be too slow / insufficient <u>diffusion</u> of oxygen / carbon dioxide ;</p> <p>(d) <u>lungs</u> / <u>gills</u>, increase the surface area (for gas exchange) ;</p> <p>(e) large(r) animals would have a high(er) demand for oxygen (due to more cells) / produce more carbon dioxide (due to more cells) ;</p>	3	

Question	Answer	Marks	Guidance
2(b)	<p><i>any four of:</i></p> <p>(a) minimum of 5 (stated) temperatures ;</p> <p>(b) method of varying temperature ;</p> <p>(c) method of measuring time (for dye to diffuse to centre) ; OR method of measuring distance dye has diffused (in set time) ;</p> <p>(d) calculate rate by distance / time taken ;</p> <p>(e) control variable linked to the block ;</p> <p>(f) control variable linked to the dye ;</p> <p>(g) repeat <u>and</u>, calculate means / averages OR discard anomalies ;</p>	4	<p>e.g. waterbath, source of warm and cold water + thermometer</p> <p>e.g same size / shape / surface area, of block / same concentration of agar</p> <p>e.g. same, type / concentration / volume, of dye</p> <p>I repeat at different temperatures</p>

Question	Answer	Marks	Guidance
3(a)(i)	<p>idea of, considers <u>risks</u> to, environment / people / named risk ;</p> <p>idea of, as there is not enough (scientific) evidence (from research) / incomplete research / unknown effect / can't predict what can happens ;</p> <p>OR</p> <p>we do not know / cannot predict what will happen ;</p> <p>therefore, go with worst scenario ;</p>	2	
3(a)(ii)	<p><i>how</i></p> <p>(a) ref. to growth (promoting) <u>gene</u> ;</p> <p>(b) ref. to use of <u>promoter</u> ;</p> <p>(c) ref. to a relevant technique ; ;</p> <p><i>why max 4</i></p> <p>(d) ref. to growth hormone (being produced by salmon) ;</p> <p>(e) provides all year growth / continuous growth / grow in cold (as well as hot) ;</p> <p>(f) reach market size faster / ready to sell faster / faster production to market ;</p> <p>(g) able to meet (consumer) demand / all year round supply ;</p> <p>(h) more efficient, energy / food, conversion ;</p> <p>(i) idea of, reduce overfishing of wild salmon / populations / stock ;</p>	5	<p>e.g. restriction enzymes / ligase / plasmid / microinjection / sterile or triploid eggs</p> <p>A grow / mature, faster</p>

Question	Answer	Marks	Guidance
3(b)	<p><i>any eight of:</i></p> <ul style="list-style-type: none"> (a) escape of fish ; (b) breeding with wild, salmon / populations / stocks ; (c) affect on gene pool / AW ; (d) <u>competition</u> for a named resource with wild fish ; (e) effect on <u>food chain</u> / <u>food web</u> ; (f) release of, waste / pollution / faeces / excess food / fertilisers ; (g) (causing) eutrophication / excess growth of algae ; (h) decomposition / (bacterial) respiration, reduces oxygen OR insufficient oxygen for fish / animal, respiration ; (i) release of, antibiotics / pesticides / herbicides ; (j) leading to resistant bacteria / pests ; (k) risk of pests / disease, spreading to wild organisms ; 	8	

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Question	Answer	Marks	Guidance
4(a)(i)	<p><i>any four of:</i></p> <p>(a) reduction in <u>biodiversity</u>;</p> <p>(b) fertiliser / named mineral ions, cause eutrophication / excess growth of algae ;</p> <p>(c) ref. to toxic algae / red tides ;</p> <p>(d) decomposition / respiration, reduces oxygen OR insufficient oxygen for, fish / animal, respiration ;</p> <p>(e) pesticide release, AND stated effect of pesticide release e.g. biomagnification / bioaccumulation / transferred through food chains ;</p> <p>(f) herbicide release, kills (primary) producers / plants / algae ;</p> <p>(g) idea of, runoff / soil enters water, causes increased turbidity / greater sediment load ;</p> <p>(h) decreases photosynthesis / damages gills / prevents filter feeding ;</p> <p>(i) idea of, land reclamation removing / damaging marine habitat ;</p>	4	A loss of species

Question	Answer	Marks	Guidance
4(a)(ii)	<p><i>any four of:</i></p> <p>(a) hot water release kills organisms ;</p> <p>(b) hot water reduces oxygen concentrations / oxygen less soluble in hot water ;</p> <p>(c) (less oxygen) results in less respiration of organisms ;</p> <p>(d) brine / high salinity water release affecting, osmosis / osmoregulation / osmoconformers ;</p> <p>(e) causes water loss from organisms ;</p> <p>(f) high salinity reduces oxygen concentrations ;</p> <p>(g) toxins / heavy metal / detergents released, kill organisms / biomagnify / bioaccumulate ;</p> <p>(h) increased turbidity, decreases photosynthesis / damaging gills / prevents filter feeding ;</p> <p>(i) (pipes) sucking in organisms / eggs ;</p>	4	<p>A once only in terms of hot water or high salinity</p> <p>A smothers organisms</p>

Question	Answer	Marks	Guidance
4(b)	<p><i>any seven of:</i></p> <p>(a) raising, awareness of / funds for conservation / human impacts on environment ;</p> <p>(b) limited number of tourists / limited access to site / limited number or size of hotels ;</p> <p>(c) use of local labour source ;</p> <p>(d) use of, sustainable / reused / recycled, materials (, in building / roads etc.) ;</p> <p>(e) idea of, reducing electricity / power use ;</p> <p>(f) idea of, being aware of C footprint / CO₂ output ;</p> <p>(g) idea of, reduction in reliance on fossil fuels / use more renewable sources ;</p> <p>(h) idea of, reduction in fresh water usage ;</p> <p>(i) idea of, waste water treatment / sewage treatment ;</p> <p>(j) idea of, reduction of non-biodegradable waste products e.g. plastics ;</p> <p>(k) idea of, recycling of waste products / suitable disposal of ;</p> <p>(l) idea of, not damaging natural habitats / environment ;</p>	7	<p>A allow idea of boosts <u>local</u> economy</p>