



Cambridge International AS & A Level

MARINE SCIENCE

9693/03

Paper 3 A2 Structured Questions

May/June 2020

MARK SCHEME

Maximum Mark: 75

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **12** 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 (see examples below)

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	<table border="1"> <thead> <tr> <th>definition</th> <th>term</th> </tr> </thead> <tbody> <tr> <td>section of DNA that controls the inheritance of a specific feature / protein</td> <td>gene</td> </tr> <tr> <td>length of DNA that switches genes on</td> <td>promoter</td> </tr> <tr> <td>transfer of genes from one species to another</td> <td>genetic engineering</td> </tr> <tr> <td>choosing parents with desired features to be bred together</td> <td>selective breeding</td> </tr> <tr> <td>the industrial application of biological processes</td> <td>biotechnology</td> </tr> </tbody> </table>	definition	term	section of DNA that controls the inheritance of a specific feature / protein	gene	length of DNA that switches genes on	promoter	transfer of genes from one species to another	genetic engineering	choosing parents with desired features to be bred together	selective breeding	the industrial application of biological processes	biotechnology	;	5
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Question	Answer	Marks
2(a)(i)	<p><i>any 2 of:</i> no difference in the amount of chlorophyll from day 0 to day 1 ; more chlorophyll in culture with iron than without from day 1 to day 7 ; ref. to, levelling off / dropping, after day 6 without iron ; ref. to, levelling off / dropping, after day 5 with iron ; ref. to manipulation of figures ;</p>	2
2(a)(ii)	<p><i>any 3 of:</i> volcanic ash added extra iron which increases chlorophyll production ; so more photosynthesis in phytoplankton ; more phytoplankton reproduction / increased productivity (causing algal bloom) ; more food (in food chain) for salmon (so numbers increased) ; takes 2 years for salmon to mature ;</p>	3
2(a)(iii)	<p><i>any 2 of:</i> it will increase phytoplankton numbers / productivity initially (as iron used for increased photosynthesis ; ref. to drop in chlorophyll after 5 days ; iron will run out ; phytoplankton will die / productivity will decrease ;</p>	2

Question	Answer	Marks
2(a)(iv)	<i>idea of:</i> measures taken to prevent harm to human health or environment (caused by human actions) ;	1
2(b)	<i>any 4 of:</i> excess phytoplankton fix more carbon during photosynthesis ; more phytoplankton die and decay ; more carbon sinks below thermocline / to deep cold water / to abyss ; where it is locked up for hundreds of years ; less carbon dioxide in the atmosphere ; CO ₂ is a greenhouse gas ; ref. to reduced greenhouse effect ; (due to) less trapping of (infra-red) radiation / heat ;	4

Question	Answer	Marks
3(a)(i)	<i>idea of:</i> maintaining a constant body / blood concentration / changes to osmotic pressure / changes to water potential ;	1
3(a)(ii)	euryhaline ;	1
3 (b)(i)	respiration ;	1
3(b)(ii)	(glucose + oxygen) → carbon dioxide and water (symbols are acceptable)	1
3(b)(iii)	<i>any 2 of:</i> <i>idea of:</i> controlling a variable ; temperatures affects rate of, respiration / oxygen consumption ; temperature affects solubility of oxygen ;	2
3(b)(iv)	<i>any 1 of:</i> <i>idea of:</i> make sure they have adjusted / acclimatised to (osmoregulating) in fresh water ; <i>idea that:</i> all fish are in the same start point / regulating in fresh water ;	1

Question	Answer	Marks
3(c)(i)	<p><i>any 4 of:</i> decreases as salinity increases to 12 ‰ and then increases ; in 0‰ and 24‰ fish are using (more) energy for osmoregulation ; energy is used for active transport (of ions) ; in 0‰ energy used to reabsorb / take in chloride ions ; in 24‰ energy used to excrete chloride ions ; in 6‰ / 12‰ less energy being used because it is close to salinity of fish blood ;</p>	4
3(c)(ii)	<p><i>any 1 of:</i> at 0 ‰ the oxygen consumption is higher than at 6, but the growth rates are the same ; or at 24 ‰ the oxygen consumption is higher than at 12, but the growth rates are the same ;</p>	1

Question	Answer	Marks
4(a)(i)	<p><i>whales:</i> internal (fertilisation) AND <i>tuna:</i> external (fertilisation) ;</p>	1
4(a)(ii)	<p><i>any 3 of:</i> <i>advantages internal vs external:</i> internal fertilisation more certain (than external) ; less energy used to produce fewer gametes ; <i>disadvantages internal vs external:</i> internal need to find a mate / idea of complex system involving hormones or mating behaviour ; fewer offspring (so less chance of passing on genes) ; ORA for external fertilisation ;</p>	3

Question	Answer	Marks
4(b)(i)	<i>any 1 of:</i> provide food for developing young ; mako shark breeds less often ;	1
4(b)(ii)	<i>any 2 of:</i> spreads out the eggs ; so increasing the survival of some offspring ; takes a lot of energy to produce egg cases as well as eggs ; needs time to replenish food stores ; groups of egg cases have to be small in number, so they can be hidden / put into cracks ;	2
4(c)	<i>any 1 of:</i> young more protected from predation; area contains food for young ; less likely to be swept away by wave action ;	1
4(d)	<i>any 2 of:</i> breed very slowly / not many offspring per year AW ; slow maturation / long time before sexually mature ; habitats are fishing areas so likely to be caught in fishing nets as by-catch / fished for food ;	2

Question	Answer	Marks
5(a)	fishing that will not affect future numbers ;	1

Question	Answer	Marks						
5(b)(i)	$340\,000 - 23\,000 = 317\,000$; $\frac{317\,000}{340\,000} \times 100 = 93.23$; decrease / – (93%) ;	3						
5(b)(ii)	<i>any 3 of:</i> closure of spawning areas to fishing ; no fishing during the winter spawning season / January to April ; no fishing on cod migration routes ; restrictions on mesh size ; restrictions on size of fish that can be retained ; extra quota on other species ;	3						
5(b)(iii)	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th data-bbox="459 735 1137 802">restriction on fishing</th> <th data-bbox="1137 735 1816 802">unrestricted fishing</th> </tr> </thead> <tbody> <tr> <td data-bbox="459 802 1137 869">sustainable future fishing</td> <td data-bbox="1137 802 1816 869">fish stocks collapse / loss of fishing industry ;</td> </tr> <tr> <td data-bbox="459 869 1137 936">ensures future employment / income</td> <td data-bbox="1137 869 1816 936">mass unemployment / loss of income ;</td> </tr> </tbody> </table>	restriction on fishing	unrestricted fishing	sustainable future fishing	fish stocks collapse / loss of fishing industry ;	ensures future employment / income	mass unemployment / loss of income ;	2
restriction on fishing	unrestricted fishing							
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5(c)(i)	adult cod numbers increased ; reached sustainable levels / MSY ;	2						
5(c)(ii)	<i>any 3 of:</i> to make sure that cod stocks do not become unsustainable again (due to overfishing) / prevent overfishing ; higher numbers of adults available in 2017 but it takes 3 to 4 years for cod to mature ; stocks are still significantly below stock levels in the 1960s and 1970s ; (although adults lay up to 1 million eggs,) few survive to adulthood ;	3						

Question	Answer	Marks
6(a)(i)	farmed fish are in large numbers close together , so easy for the sea lice to transfer between hosts ;	2
6(a)(ii)	<i>any 2 of:</i> there will fewer wild salmon to catch ; increasing use of chemicals could make the wild salmon infertile, (so there would be less to catch) ; increasing numbers of sea lice could spread to wild salmon (and reduce wild salmon numbers) ;	2
6(a)(iii)	genotype ;	1
6(b)(i)	no need / less need to use harmful chemicals ;	1
6(b)(ii)	<i>any 3 of:</i> no / fewer wrasse present to eat sea urchins / limpets / periwinkles ; as sea urchin / limpet / periwinkle population increases ; so kelp forest will decline as more being consumed ; less food for other organisms feeding on kelp (in the food web) ;	3

Question	Answer	Marks
7(a)(i)	<i>any 3 of:</i> protected from waves / adverse weather ; flow of river water flushes waste from the fish cages out to sea; water flow renews oxygen for respiration; close to town for selling fish locally; close to town for labour ; close to town and transport links for export ;	3
7(a)(ii)	<i>any 3 of:</i> more salmon use more oxygen for respiration, (so levels fall) ; waste food/faeces from salmon fall (to the sediment below) ; where they are broken down by bacteria / decomposers which use oxygen ; creating dead zones (under cages) ;	3
7(b)(i)	<i>idea of:</i> a person who has an interest (commercial or ecological) in a particular area ;	1

Question	Answer	Marks
7(b)(ii)	<p><i>any 1 of matching stakeholder and reason:</i> local / commercial fisherman ;</p> <p>polluted water will reduce fish catch ;</p> <p>or local boat owner ;</p> <p>loss of income as tourists will not want to visit polluted harbour ;</p> <p>or local hotel owner ;</p> <p>loss on income as less tourists visit the area ;</p>	2
7(c)	It will release the mining waste bound in the sediment, which could be <u>toxic</u> to fish / marine life in the harbour ;	1
7(d)	<p><i>any 3 of:</i> commercial fishing / netting catch adults in shallow water ; fewer adults left to breed ; water quality too poor for adults to breed / lay eggs in deep water ; fewer juveniles produced so population will decline ;</p>	3