



# **Cambridge International AS & A Level**

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**MARINE SCIENCE**

**9693/31**

Paper 3 A Level Theory Paper

**October/November 2023**

**MARK SCHEME**

Maximum Mark: 75

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**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 October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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This document consists of **11** 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.

**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)(i)	C D E A B F All 6 correct, 4 marks 5 correct, 3 marks 4 correct 2 marks 2 or 3 correct, 1 mark	4
1(a)(ii)	<i>any 2 of:</i> (cellulose) cell wall ; (large) <u>permanent</u> vacuole ; chloroplasts ;	2
1(a)(iii)	(ensure that) <u>aerobic</u> respiration (occurs) ; which releases <u>more energy</u> than anaerobic respiration ;	2

Question	Answer	Marks
2(a)(i)	<i>any 2 of:</i> blocks light (from penetrating water) ; so less / no, photoactivation of chlorophyll ; reduced dissolution of carbon dioxide (from atmosphere) ; less / no, carbon dioxide <u>fixed</u> (during light-independent stage) ;	2

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Question	Answer	Marks
2(a)(ii)	<p><i>booms:</i> marine organisms / mammals, could become entangled in ropes / chains <b>or</b> <u>marine mammals</u> could collide with boom <b>or</b> anchors / chains on sea bed damage corals / benthic habitat ;</p> <p><i>chemicals</i> (chemicals used to disperse oil) are <u>toxic</u> to marine organisms ;</p>	<b>2</b>
2(b)	<p><i>any 3 of:</i></p> <p>oil sticks to feathers of birds <b>AND</b> any suitable effects ;</p> <p>oil kills prey species / reduced food source <b>AND</b> any suitable effect ;</p> <p>ingest oil <b>AND</b> any suitable effect ;</p> <p>oil covers nests <b>AND</b> any suitable effect ;</p>	<b>3</b>
2(c)	<p><i>any 3 of:</i></p> <p>fewer / no tourists will visit, so less income / loss of employment ; fewer tourists, so less money invested in conservation ; reduced fish numbers, as fish move away from / are killed by toxins (in polluted areas) ; reduced fish numbers so, less fish to eat / more money spent on buying food / price of fish increases ; less fish to catch / sell, so reducing, income / employment (in fishing industry) ; health risks of eating contaminated fish ;</p>	<b>3</b>

Question	Answer	Marks
3(a)(i)	<i>any 2 of:</i> (minimum extent of) Arctic Ocean ice has <u>decreased</u> , by 3.8 million km <sup>2</sup> / by (approx.) 50% ; (increased temperatures in the Arctic are causing), more of the ice to melt in summer / less ice to form in winter ;	<b>2</b>
3(a)(ii)	<i>any 4 of:</i> (increased) <u>melting</u> of ice / ice breaks up into smaller pieces ; loss of ice as a (thermal) insulator ; <u>reduced reflection</u> of light / <u>more light energy absorbed</u> by sea water ; decreases salinity (due to increase in fresh water) ; reduced salinity increases / increased temperatures decreases, solubility of gases ; ref. to change in salinity causing change in halocline <b>or</b> change in temperature causing change in thermocline ; ref. to potential changes to ocean currents ; AVP ;	<b>4</b>
3(b)(i)	easier to swim beneath the, ice / glaciers ; increased ability to catch prey, near surface / under ice ; less surface area for heat loss ; body more streamlined so, saves energy when swimming ;	<b>2</b>
3(b)(ii)	<i>any 2 of:</i> increased <u>food availability</u> in summer (due to high productivity) ; idea of (excess) food stored as fat ; fat provides <u>energy source</u> during the winter (when food is scarce) ; extra / stored fat, helps to insulate body / retains body heat ;	<b>2</b>
3(c)	<i>any 3 of:</i> Russia is already ice-free in summer ; sea ice is decreasing ; (sea water) temperatures are increasing ; so frozen, sediment / methane, thaws ; releasing more methane into sea ; methane escapes (from sea surface) into atmosphere ; the <u>graph</u> for global atmospheric methane shows an increasing trend ; AVP ;	<b>3</b>

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Question	Answer	Marks
4(a)(i)	<i>any 1 of:</i> different <u>forms</u> of the same animal ; adult and larval (forms) present ; process of transformation / change from immature to adult form ;	<b>1</b>
4(a)(ii)	<i>any 2 of:</i> cooler / more temperature stable ; increased pressure ; oxygen concentration decreases ; ref. to salinity increasing / density increasing ; water darker (due to less light penetration) ;	<b>2</b>
4(b)	<i>any 4 of:</i> increasing carbon dioxide decreases <u>hatch rate</u> ; so krill population decreases ; increased dissolution of carbon dioxide ; forms hydrogen <u>ions</u> and hydrogencarbonate <u>ions</u> ; increased ocean acidification / pH decreases ; less carbonate for krill <u>exoskeleton</u> ; so krill deformed / more easily preyed upon ;	<b>4</b>
4(c)(i)	<i>satellite tracking:</i> can ensure vessel is fishing in correct location / can show when a vessel is fishing / can show method of fishing ; <i>observer:</i> can inspect catch size or limit / monitor fishing gear / ensure that there is no by-catch ;	<b>2</b>
4(c)(ii)	<i>any 1 of:</i> depth of shoal / size of shoal / underwater objects / depth of water ;	<b>1</b>
4(c)(iii)	<i>any 2 of:</i> idea of less <u>competition</u> , from krill predators / fish / squid / whales / seals / penguins ; so Antarctic krill numbers higher further from shore ; so quota can be increased ; less fuel required to reach fishing areas ; AVP ;	<b>2</b>



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Question	Answer	Marks
4(d)	<p><i>any 2 of:</i></p> <p>countries which are not members are not bound by the rules ;</p> <p>ref. to IUU fishing ;</p> <p>will result in overfishing ;</p> <p>ref to all 25 countries have to agree to any (change in) regulation ;</p> <p>fishing in area / number of licenses, is restricted ;</p> <p>to maintain <u>sustainable</u> fishing ;</p>	<b>2</b>

Question	Answer	Marks
5	<p><i>any 9 of:</i></p> <p>1 sea water has a lower <u>water potential</u> than, the blood / body fluids of tuna ; <b>ORA</b></p> <p>2 so water is (continuously) lost (through skin) ;</p> <p>3 by osmosis ;</p> <p>4 which could lead to dehydration ;</p> <p>5 tuna <u>regulates</u> its (internal), water / ion concentration ;</p> <p>6 so that their, internal concentration / concentration of blood / body fluids is (fairly) constant ;</p> <p>7 drinks sea water ;</p> <p>8 which contains salts / ions ;</p> <p>9 to <u>replace</u> water lost (by osmosis) ;</p> <p>10 salts <u>diffuse</u> into body through skin ;</p> <p>11 sodium / chloride, (ions) secreted / removed by gills ;</p> <p>12 using ATP / energy / is an active process ;</p> <p>13 magnesium / sulfate ions, (actively) secreted by kidney ;</p> <p>14 reabsorption of water in kidney ;</p> <p>15 so small volume of concentrated urine released ;</p>	<b>9</b>

Question	Answer	Marks
6(a)	<p><i>any 5 of:</i></p> <ol style="list-style-type: none"> <li>1 include, most types of / terrestrial / coastal / marine, ecosystems ;</li> <li>2 promotes / increases awareness of, conservation issues ;</li> <li>3 suitable example e.g. protecting vulnerable species / allows vulnerable species to repopulate ;</li> <li>4 sites, nominated / funded / maintained, by (national) governments ;</li> <li>5 UNESCO sites are found worldwide / in over 100 (129) countries ;</li> <li>6 involve local communities in planning / management / brings benefits to local communities ;</li> <li>7 ref. to core area where species are strictly protected / no human activity is allowed ;</li> <li>8 ref. to a buffer area, where human activity is controlled / used for education / research / monitoring / training ;</li> <li>9 ref. to interactive / transition / sustainably developed, area which allows, sociological / economic human activities e.g. ecotourism ;</li> <li>10 AVP ;</li> </ol>	5
6(b)	<p><i>any 10 of:</i></p> <ol style="list-style-type: none"> <li>1 have a high / help maintain, biodiversity ;</li> <li>2 <u>blades</u> help to dissipate wave action ;</li> <li>3 <u>holdfast</u> stabilises, sediment / sea bed ;</li> <li>4 so reducing (coastal), erosion / flooding ;</li> <li>5 carry out photosynthesis / are primary producers ;</li> <li>6 <u>fix</u> carbon to make, glucose / organic compounds ;</li> <li>7 source of energy for consumers ;</li> <li>8 are important, habitats / nursery areas (for juvenile fish / invertebrates) ;</li> <li>9 as they provide shelter from predators ;</li> <li>10 source of oxygen for consumer respiration ;</li> <li>11 increases, fish / invertebrate stocks, in surrounding areas ;</li> <li>12 (some of which) are fished commercially ;</li> <li>13 so provide a source of income ;</li> <li>14 food source / source of pharmaceutical products / gels / alginates, for humans ;</li> <li>15 collected and used as a fertiliser ;</li> <li>16 act as a carbon sink / store carbon ;</li> <li>17 due to high productivity (in tropical areas) ;</li> <li>18 source of recycled nutrients when they die and decompose ;</li> </ol>	10

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Question	Answer	Marks
7	<p>any <b>6</b> of:</p> <ol style="list-style-type: none"> <li>1 prevents / reduces, fish deaths / loss of income ;</li> <li>2 greater need in, intensive systems / high stocking densities ; <b>ORA</b></li> <li>3 parasites / disease causing organisms / pathogens need to be removed / killed ;</li> <li>4 or spread disease, to healthy organisms / to next batch ;</li> <li>5 adding lime to ponds after harvest ;</li> <li>6 disinfecting / sterilizing, tanks / equipment (after use) ;</li> <li>7 using UV light (in hatcheries) ;</li> <li>8 adding, antibiotics / fungicides / pesticides ;</li> <li>9 vaccination ;</li> <li>10 develops immunity ;</li> <li>11 ensure clean water supply / uncontaminated water supply ;</li> <li>12 buy / use, disease-free fish to stock, pond / tanks ;</li> <li>13 use of quarantine tanks for, new / diseased fish ;</li> </ol>	<b>6</b>