



Cambridge International AS & A Level

MARINE SCIENCE

9693/31

Paper 3 A Level Theory Paper

October/November 2022

MARK SCHEME

Maximum Mark: 75

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 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **13** 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

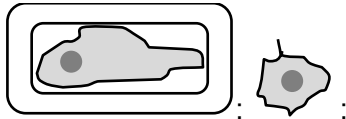
Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

PUBLISHED

- This mark scheme will use the following abbreviations:
 - ;
/ separates marking points
 - () separates alternatives within a marking point
 - R contents of brackets are not required but should be implied / the contents set the context of the answer
 - A 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
 - underline 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)

PUBLISHED

Question	Answer				Marks																
1(a)(i)	<table><tr><th>process</th><th>movement from a high concentration to a lower concentration</th><th>is a passive process</th><th>used for glucose uptake</th></tr><tr><td>diffusion</td><td>✓</td><td>✓</td><td></td></tr><tr><td>facilitated diffusion</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>active transport</td><td></td><td></td><td>✓</td></tr></table> ;				process	movement from a high concentration to a lower concentration	is a passive process	used for glucose uptake	diffusion	✓	✓		facilitated diffusion	✓	✓	✓	active transport			✓	3
process	movement from a high concentration to a lower concentration	is a passive process	used for glucose uptake																		
diffusion	✓	✓																			
facilitated diffusion	✓	✓	✓																		
active transport			✓																		
1(a)(ii)	it only applies to water ;				1																
1(b)(i)					2																
1(b)(ii)	correct label on both cells ;				1																
1(b)(iii)	water diffuses from an area of high water potential inside the cell ; out into the (concentrated) sugar solution / to area of lower water potential ; so cell membrane pulls away from cell wall in a plant cell ; <u>animal cell</u> shrinks ;				4																

PUBLISHED

Question	Answer	Marks
2(a)(i)	any 4 of: use inorganic chemicals / dissolved substances ; e.g. hydrogen sulfide / methane / hydrogen / iron / carbon dioxide ; to provide (chemical) energy ; to fix carbon ; in organic compounds / glucose / carbohydrates ;	4
2(a)(ii)	any 3 of: has a symbiotic relationship / example of mutualism ; <i>Endoriftia</i> lives inside the <i>Riftia</i> / <i>Riftia</i> provides shelter for <i>Endoriftia</i> ; <i>Riftia</i> transports, carbon dioxide / hydrogen sulfide / minerals, to <i>Endoriftia</i> ; <i>Endoriftia</i> makes, organic compounds / glucose / carbohydrates, for <i>Riftia</i> ;	3
2(a)(iii)	vent octopus has only 3 trophic levels / vent ratfish has 4 trophic levels ; energy is lost at each stage of the food chain ; or only around 10% of energy is transferred at each stage ;	2
2(b)(i)	any 3 of: increase in sediment would, block gills of fish / invertebrates, or fish cannot find food ; increase in sediment covers bacterial mats, so food unavailable for consumers ; sediment / oil would release toxins, that could, poison / bioaccumulate in, marine organisms ; increase oil seepage, so community could not adapt ;	3
2(b)(ii)	any 3 of: more (methane) gas escapes / rises to the surface ; enters atmosphere ; traps more heat (within atmosphere) ; contributes to global warming / global temperatures increase ;	3

PUBLISHED

Question	Answer	Marks
3(a)	euryhaline ;	1
3(b)(i)	many larval stages ; metamorphosis occurs ;	2
3(b)(ii)	larvae ;	1
3(c)	advantages: any 2 of: supply guaranteed ; does not reduce food supply for wild birds / ducks ; spat protected from, adverse weather / pollution / toxins from algal blooms / predators ; spat protected from temperature increases due to climate change ; AVP ; disadvantages: any 2 of: high cost of setting up hatchery ; high running / maintenance costs e.g. pump / filtration / aeration ; mussels / larvae will need to be fed ; AVP ;	4

PUBLISHED

Question	Answer	Marks
3(d)	advantages – any 2 of: - easier to check growth ; - easier to harvest (from land) / no need for a boat to harvest ; - muddy shores and estuaries are high in nutrients ; - regular water flow brings food / phytoplankton ; - regular water flow washes away waste products ; - regular water flow maintains oxygen levels (for respiration) ; - easier to check for predators / biofouling ; - estuaries more protected from wave action / storms ; disadvantages – any 2 of: - mussels exposed, to atmosphere / during low tide ; - so greater chance of, predation by birds / desiccation / temperature or salinity fluctuations ; - less time available to feed ; - so less growth ; - longer time before harvest ; - greater chance of being affected by algal blooms / pollutants ; - greater risk of sediment blocking gills ;	4

PUBLISHED

Question	Answer	Marks
4(a)	shared electrons ; two pairs of electrons shared (between the two atoms) ;	2
4(b)(i)	<i>any 2 of:</i> Earth's atmosphere is getting warmer ; oceans absorb heat ; (heat causes) increased evaporation which increases salinity ; oxygen is less soluble, in warmer water / more saline water ; (warmer water) inhibits the production of oxygen from photosynthesis / producers;	2
4(b)(ii)	<i>any 3 of:</i> sharks and tuna are much larger animals / more active animals / ORA ; require more energy for muscle contraction ; energy / ATP provided by respiration ; (aerobic) respiration requires oxygen ;	3

PUBLISHED

Question	Answer	Marks
5	any 10 of: advantages: 1 provide shelter from water currents / waves / storms ; 2 provide shelter from predators ; 3 enhance an existing <u>habitat</u> / provide a new <u>habitat</u> ; 4 provide a substrate for sessile species / producers / algae / corals / sponges / larval attachment ; 5 increase in producers, attracts / provides food, for more consumers ; 6 increasing biodiversity ; 7 provide nursery areas, (so populations increase) ; 8 can be used with aquaculture ; 9 as a source of wild fish / shellfish ; 10 filter feeders on reef improve water quality for other species ; 11 provide a source of, fish / invertebrates, for fishing industry ; 12 so reducing pressure on natural reefs ; disadvantages: 1 material used for construction needs to remain in place on seabed ; 2 or it could move during winter storms ; 3 so damaging benthic organisms / natural reefs ; 4 unsuitable material can be toxic to marine organisms ; 5 e.g. ships deliberately sunk may still contain oil / paint ; 6 unsuitable material might erode quickly ; 7 so can only provide a temporary habitat ; 8 cost of (specially made) building materials can be high ; 9 e.g. reef balls ; 10 could introduce / be a spawning ground for invasive species ; 11 takes time / many years for an ecosystem to develop ; 12 tourism could drive away fish stocks ;	10

PUBLISHED

Question	Answer	Marks
6(a)	<i>any 5 of:</i> 1 mouth opens + operculum closes ; 2 volume of buccal cavity is increased ; 3 by muscle contraction (and relaxation) ; 4 pressure in buccal cavity is lowered / lower than in sea water ; 5 water flows into mouth (due to pressure difference) ; 6 ref. to pumped ventilation ; 7 ref. to requiring energy / ATP / is an active process ;	5
6(b)	<i>same phylum – max 3 of:</i> 1 they are both are chordates ; 2 as they have a notochord ; 3 dorsal neural tube ; 4 pharyngeal slits ; 5 post-anal tail ; <i>different class – max 3 of:</i> 1 shark has a cartilaginous skeleton, grouper has a bony skeleton ; 2 shark has gill slits, grouper has an operculum ; 3 only grouper has a swim bladder ; 4 grouper skin covered in scales, shark skin covered in denticles ;	6

PUBLISHED

Question	Answer	Marks
7	any 9 of: 1 invasive species are non-native ; 2 introduced to a new ecosystem by release of ballast water / escape from aquariums / accidentally released by humans ; 3 suitable example e.g. crown-of-thorns starfish / Asian shore crab ; 4 rapid growth rate ; 5 high, breeding success / recruitment rate / fecundity ; 6 (invasive animal) eat a <u>wide variety</u> of prey / native species ; 7 suitable effect on native species ; 8 no / few natural predators ; 9 <u>outcompetes</u> native species ; 10 can lead to native marine species becoming endangered / extinct / migrating to other areas ; 11 decrease biodiversity ; 12 permanently alter habitats ; 13 causes economic loss of, income / employment, from, tourism / fishing industry ; 14 reduce fish numbers for, fishing / feeding population ; 15 costly to, remove / introduce prevention methods ; 16 could introduce disease into the local ecosystem ;	9