CAMBRIDGE
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Cambridge International AS & A Level

MARINE SCIENCE **9693/31**

Paper 3 A Level Theory Paper **October/November 2024**

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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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 descriptions 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)	x 5000 ;	**1**
1(a)(ii)	B B A or D C E All 5 correct, 3 marks 3 or 4 correct, 2 marks 2 correct, 1 mark	**3**
1(b)(i)	any correct definition, e.g. the tendency for water to move, out of a solution / from a high water potential to a low water potential ;	**1**
1(b)(ii)	*any **4** of:* 1 glucose dissolves (in cytoplasm / vacuole) ; 2 so decreases the water potential inside the cell ; 3 higher water potential outside the cell than inside ; 4 so water enters cell (by osmosis) ; 5 starch does not dissolve (in the cytoplasm / vacuole) ; 6 so has no effect on water potential / osmosis ;	**4**

Question	Answer	Marks
2(a)	(protein) required for growth / muscle development ;	**1**
2(b)(i)	*any **3** of:* 1 increasing demand / use, for aquaculture ; 2 will increase price ; 3 supply of anchovies / sardines, decreasing / unreliable ; 4 do not want to use a fish that is food for humans ; 5 removes prey for many marine species ; 6 so disrupts food chains / food webs ;	**3**

Question	Answer	Marks
2(b)(ii)	*any **4** of:* 1 **both** are suitable replacements (as mean percentage mass gain + mean % daily growth rate and survival are very similar to control) ; 2 suitable comparison from table ; 3 correct manipulation of figures from table ; 4 correct ref. to protein content of soybean, fermented soybean and fishmeal ; 5 soybean might not have the correct balance of amino acids ; 6 **AVP** ;	**4**
2(c)	*advantages: any **2** of:* 1 less labour required / less labour costs ; 2 *idea of* less time required to feed fish ; 3 correct volume of feed delivered ; 4 fish fed at regular times ; *disadvantages: any **2** of:* 5 high cost of automatic feeder / installation; 6 cannot see feeding response; 7 so cannot see if all food is eaten ; 8 *idea of* uneaten food causing pollution ; 9 not as easy to check fish for, disease / parasites / damage ;	**4**

Question	Answer	Marks
3(a)(i)	(chemosynthetic) bacteria ;	**1**
3(a)(ii)	*any **2** of:* too deep for light to penetrate; no plants / algae present ; (photosynthetic) enzymes denature due to extreme temperature ;	**2**
3(b)(i)	*any **1** of:* fossil fuels are, running out / a finite energy source ; (burning fossil fuels), releases greenhouse gases which, increase global warming / increase ocean acidification ;	**1**

Question	Answer	Marks
3(b)(ii)	*any **2** of:* 1 cost of these elements is increasing ; 2 elements are in short supply / rare on land ; 3 demand (for batteries) is increasing / exceeds supply ; 4 disposing of waste material from land extraction is, expensive / (often) toxic to the environment ; 5 **AVP ;**	**2**
3(b)(iii)	*any **2** of:* 1 extreme, depth / pressure / temperature / pH / toxic environment; 2 specialised / expensive equipment required ; 3 often a long way from shore ; 4 **AVP** ;	**2**
3(b)(iv)	*any **4** of:* 1 increases sediment (from return pipe), can block gills of fish / smothers benthic organisms / affects feeding in filter-feeders; 2 increases sediment (from return pipe), reduces visibility for catching prey ; 3 increases sediment releases toxins which poison marine organisms ; 4 noise / vibrations (from equipment), drives fish / mammals away ; 5 noise / vibrations (from equipment), interferes with communication of marine mammals ; 6 noise / vibrations (from equipment), interferes with breeding in fish / mammals ; 7 extraction damages / destroys habitats / hydrothermal vent community ; 8 increased light pollution, drives away marine organisms ; 9 pollutants / toxic products could bioaccumulate in marine organisms ; 10 **AVP** ;	**4**

Question	Answer	Marks
4(a)(i)	important in photosynthesis **AND** respiration ; (in respiration) provides oxygen **AND** removes carbon dioxide **OR** (in photosynthesis) provides carbon dioxide **AND** removes oxygen ;	**2**
4(a)(ii)	*any **2** of:* 1 gills increase surface area (to volume ratio) in fish, tentacles increase surface area (to volume ratio) in coral polyps ; 2 most parts of the body in fish are far away from the surface, in coral polyps all parts of the body are close to the surface; 3 too far for diffusion to occur in fish / diffusion distance is large, diffusion is sufficient / diffusion distance is small in coral polyps ; 4 fish move (so require more energy), coral polyps are sedentary ; 5 **AVP** ;	**2**
4(b)	*any **2** of:* gill **A – no mark** 1 phytoplankton are small / microscopic ; 2 rakers are closer together / longer / more rakers ; 3 so able to filter out phytoplankton ;	**2**
4(c)	*any **4** of:* 1 mackerel is a fast-moving fish, so requires more oxygen / energy demand (than marine catfish) ; 2 larger area of lamellae in marine catfish, to obtain enough oxygen ; 3 more oxygen present in epipelagic zone (compared with benthic zone) ; 4 lamellae thinner in mackerel, so less distance for diffusion (of oxygen into blood) ; 5 lamellae walls thinner, so faster diffusion of oxygen ; 6 lamellae more closely packed in mackerel, to slow down water movement ; 7 allowing more time for diffusion of gases / maintains diffusion gradient / greater gas exchange ;	**4**
4(d)	*any **2** of:* 1 ref. to counter-current mechanism ; 2 maintains diffusion gradient (across whole gill surface / length of gill) ; 3 (more efficient as), more / higher percentage of, oxygen can diffuse into blood ; 4 in **A** diffusion occurs only until, equilibrium is reached / oxygen content of sea water is the same as in the blood ;	**2**

Question	Answer	Marks
5	*any **7** of:* 1 (most) ships fitted with AIS (automatic identification system) ; 2 uses navigation / communication satellites ; 3 to communicate, between vessels / with shore ; *advantages* 4 provides real-time data / rapid transfer of information ; 5 shows location of boat ; 6 speed ; 7 course ; 8 can check to see if boat is in MPAs / restricted areas ; 9 catch, if using electronic logbooks ; 10 reaches all areas of ocean **OR** *idea of* constant monitoring ; *disadvantages* 11 can be costly ; 12 not all ships use AIS / have the technology ; 13 manual inspections still need to be carried out ; 14 (AIS) can be switched off (for illegal fishing) ; 15 **AVP** ;	**7**

Question	Answer	Marks
6(a)	*any **10** of:* 1 are phytoplankton ; 2 which carry out photosynthesis ; 3 absorb nutrients from their environment ; 4 productivity limited by available nutrients / light / low temperatures ; 5 use (dissolved) carbon dioxide ; 6 which reduces concentrations in sea water ; 7 reduces effect of ocean acidification ; 8 give out oxygen ; 9 for aerobic respiration in marine organisms ; 10 produce, glucose / carbohydrate / organic compounds ; 11 as food / energy source for zooplankton / consumers ; 12 form a habitat for zooplankton / larvae ; 13 when they die, they fall to ocean floor ; 14 *idea of* nutrients recycled ; 15 can cause algal blooms / algal overgrowth (if productivity is too high) ; 16 can result in eutrophication ; 17 act as a carbon sink ; 18 so helps reduce global warming ; AW 19 **AVP ;**	**10**
6(b)	*any **7** of:* 1 accessory pigments trap / absorb light (energy) ; 2 at different wavelengths ; 3 during light-dependent stage (of photosynthesis) ; 4 pass light energy on to chlorophyll a ; 5 accessory pigments include, chlorophyll b / carotenoids / xanthophylls / phycobilins ; 6 wavelength varies with depth ; 7 red light / long wavelength, only penetrates shallow water **AND** blue light / short wavelength, penetrates deeper water ; 8 green algae contain chlorophyll ; 9 which absorbs red light / wavelengths of (around) 670 nm **AND** blue light / wavelengths at (around) 450 nm ; 10 brown algae contain fucoxanthin / xanthophylls ; 11 which absorb wavelengths of (around) 450 nm / in blue end of spectrum ; 12 red algae contain phycobilins / phycocyanin / phycoerythrin ; 13 which absorb wavelengths of between 500 to 600 nm / in yellow – green areas of spectrum ;	**7**

Question	Answer	Marks
7	*any **6** of:* 1 greater production / use of (micro)plastic ; 2 microplastic is not biodegradable ; 3 large plastic items can be broken down into <u>secondary</u> microplastics ; 4 by UV radiation ; 5 wind action / wave action ; 6 (process increases at) <u>higher</u> temperatures ; 7 primary microplastics are not broken down from larger plastic ; 8 e.g. microbeads from the cosmetic industry ; 9 e.g. microfibres from clothes ; 10 ref. to suitable method (micro)plastic reaches the marine environment ; 11 e.g. fragments of nylon from fishing nets (enter marine environment directly) ; 12 **AVP** ;	**6**