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**MARINE SCIENCE**

**9693/04**

Paper 4 A2 Data-Handling and Free-Response

**October/November 2019**

MARK SCHEME

Maximum Mark: 50

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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.

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This document consists of **9** 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.

Question	Answer	Marks	Guidance
1(a)(i)	1.1 ;	1	1.05–1.15
1(a)(i)	correctly calculated change in depth of corrosion (e.g. 1.2–0.6) ; division by appropriate correct change in time (e.g. 20–10 = 10) ; units (mm year <sup>-1</sup> ) ;	3	<b>A</b> 0.06 mm year <sup>-1</sup> for 3 marks
1(a)(iii)	(after 70 years corrosion would be) 5.6 mm / greater than 5 mm / all way through steel ; oil could begin to leak through / <b>AW</b> ;	2	e.g. 0.08 · 70 = 5.6 mm
1(a)(iv)	<i>any 2 of:</i> toxicity / food chain bio-accumulation / <b>AW</b> ; suffocation of organisms / oxygen depletion / damages gills / smothers gills ; damage to, feathers of birds / fur <b>OR</b> smothering of mammals ; reduced, primary productivity / photosynthesis ; <b>AVP</b> ;	2	e.g. damage to substrates on shoreline
1(b)	<i>any 4 of:</i> 1. percentage cover by coral increases with age of wreck (between 10–40 years) ; 2. the data is about coverage not biodiversity / is not a measure of biodiversity ; 3. there is no information about species numbers or types ; 4. percentage cover by, barnacles / molluscs, does not change / fluctuates / description of fluctuates ; 5. percentage cover by sponges decreases with age ; 6. reef cover increases with age / cover with no organisms decreases (between 10–40 years) ; 7. <i>idea that</i> , Japan wreck, is anomalous / has lower coral coverage ; 8. wrecks are at different depths / Japan wreck is deeper (so is not a fair comparison) ; 9. other factors (diving or fishing) vary and so it is not a fair comparison ; 10. wrecks are in different areas / location of wrecks may vary (affecting the colonisation) ;	4	<b>A</b> percentage cover by coral increases with age  <b>A</b> number of individuals not given

Question	Answer	Marks	Guidance
2(a)(i)	81.9 ; 16.9(4) % / 17 % ;	<b>2</b>	correct subtraction (483.5–401.6 = 81.9) ;  divided by yield with no shrimp and multiplied by 100 ;  correct answer of 16.94% or 17% gains two marks
2(a)(ii)	<i>any 2 of:</i> adding low density shrimp increases the yield of tilapia ; adding shrimp at medium <u>and</u> high density reduces yield of tilapia ; adding shrimp at high density causes a <u>very high</u> reduction in yield of tilapia ;	<b>2</b>	
2(a)(iii)	<i>any 2 of:</i> food / nutrient, <u>type</u> ; food quantity / feeding frequency / <b>AW</b> ; size of tank ; water volume ; temperature ; pH ; salinity ; oxygen ; light ; age / species of fish ;	<b>1</b>	two factors needed for one mark

Question	Answer	Marks	Guidance
2(b)	<i>any 3 of:</i> 1. shrimp prevent pollution / shrimp clean tanks / less need to clean tanks / reduced cleaning costs ; 2. reducing eutrophication / dead zones ; 3. <i>idea of</i> , shrimp are a saleable product ; 4. if added at low density, they enhance the productivity of tilapia (increasing profits) ; 5. provides, a product / fertiliser, (from the waste) ; 6. reduce risk of disease ; 7. no need to buy food / less food needed, for shrimp ;	<b>3</b>	<b>A</b> correct environmental effect

Question	Answer	Marks	Guidance
3(a)	oxygen concentration is low (in water) / <b>ORA</b> ; oxygen concentration (in water) is more variable / oxygen varies with depth (in water) ;	<b>2</b>	
3(b)	<i>any 8 of:</i> 1. ref. to diffusion (in coral / grouper) ; 2. ref. to large gas exchange surface areas / Surface Area : Volume ratio (in coral / grouper) ; 3. ref. to short diffusion path / thin layer of cells / <b>AW</b> (in coral / grouper) ; 4. ref. to high to low concentration of oxygen / carbon dioxide ;  5. in coral oxygen diffuses directly into cells / tissues / across body surface / grouper use gills / <b>ORA</b> ; 6. corals may move tentacles (to increase gas exchange) ; 7. grouper use pumped ventilation / <b>ORA</b> ; 8. (grouper) gills have large surface area due to filaments / lamellae ; 9. grouper use blood to transport oxygen / <b>ORA</b> ; 10. grouper actively pumps water through gills / uses muscle contraction / uses energy to pump water / <b>ORA</b> ; 11. grouper use a counter current mechanism / <b>ORA</b> ; 12. coral polyps have lower demand for oxygen / <b>ORA</b> ;	<b>8</b>	<b>A</b> diffusion down the diffusion / concentration gradient
3(c)	<i>any 5 of:</i> 1. toxins / detergents may directly harm organisms ; 2. <i>idea of</i> , bioaccumulation ; 3. organic waste causes, microbes / bacteria / decomposers / decomposition rate, to increase ; 4. (bacteria) respire ; 5. using up oxygen / creating dead zones ; 6. (mineral ions may cause) algal blooms / eutrophication / <b>AW</b> ; 7. and death of algae due to over competition for light ; 8. sediment may damage gills of organisms / <b>AW</b> ; 9. turbidity may reduce light penetration / reduce photosynthesis ; 10. microbes may cause disease ;	<b>5</b>	

Question	Answer	Marks	Guidance
4 (a)	<p><i>any 3 of:</i></p> <ol style="list-style-type: none"> <li>1. two correct named species ;</li> <li>2. possible to choose mates ;</li> <li>3. less waste of gametes / less gametes produced / gametes not washed away ;</li> <li>4. less energy wasted ;</li> <li>5. allows internal development (of offspring) ;</li> <li>6. higher probability of fertilisation ;</li> </ol>	<b>3</b>	
4(b)	<p><i>any 4 of:</i></p> <ol style="list-style-type: none"> <li>1. synchronisation of gamete release ;</li> <li>2. trochophore larvae ;</li> <li>3. veliger larvae ;</li> <li>4. ref. to planktonic larvae / larvae feed on plankton ;</li> <li>5. development of foot / pediveliger ;</li> <li>6. sinking and, settling / attach to substrate ;</li> <li>7. (spats) begin as males ;</li> <li>8. later turn into females (after growth) ;</li> </ol>	<b>4</b>	



