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**MARINE SCIENCE**

**9693/04**

Paper 4 A2 Data Handling and Free-Response

**October/November 2018**

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.

Cambridge International is publishing the mark schemes for the October/November 2018 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 **8** 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.

Question	Answer	Marks	Guidance
1(a)(i)	<p><i>Any two of:</i></p> <p>(idea of) spread about the mean ;            (standard deviation shows) variation in catch over different years / low standard deviation suggests similar catch each year (for a month) / <b>ORA</b> ;            Feb / Nov / Dec show highest variation in catches ;            greater catches / more hooks used, have higher the standard deviation / <b>ORA</b> ;</p>	<b>2</b>	
1(a)(ii)	<p>both <b>axes</b> labelled with units ;            linear <b>scales</b> for axes ;            correct series <b>plots</b> ; ;            straight <b>lines</b> with key / ruler drawn bars with key ;</p>	<b>5</b>	<p><b>A</b> either bar chart or lines joining points  <b>A</b> two separate graphs or one with two y axes</p> <p><b>A</b> <math>\pm \frac{1}{2}</math> small square on plotting</p>
1(b)	7.3 / 7.27 ;	<b>1</b>	
1(c)	<p><i>Any three of:</i></p> <p>(albacore fishing) is sustainable ;</p> <p>(because) CPUE for albacore is fairly constant / risen (so stocks are healthy) ;</p> <p>(however) more information needs to be gathered / other factors could affect the sustainability ;            2015 is not long enough in future to see the effects of overfishing ;            credit a specific example of a factor that could affect CPUE ;</p>	<b>3</b>	<p>e.g. Fishing methods may be more efficient and stocks are not healthy</p>

Question	Answer	Marks	Guidance
2(a)(i)	22 or 23 ;	1	
2(a)(ii)	<p><i>Any three of:</i></p> <p>mean ventilation rate increases (so supports the conclusion) ;  fish 1 ± fish 2 show an increase / all fish increase up to 20 °C ;</p> <p>(however) fish 3 decreases the rate at 25 °C ;  there is a narrow range of temperatures ;  there are, too few repeats / only been done with three fish / only carried out for 30s ;</p> <p>fish 2 has higher rate but the trend is still an increase ;</p> <p>increase in rate between 20 and 25 °C is less / <b>AW</b> ;</p>	3	
2(b)	<p><i>Any five of:</i></p> <p>fish placed into (minimum) four different concentrations of sodium hydrogen carbonate solutions / carbon dioxide concentrations ;  made by dilutions with water / adding different volumes to water / <b>AW</b> ;  measured using pipettes / syringes/ <b>AW</b> ;</p> <p>count mouth openings in stated time ;</p> <p>repeats and determine means ;</p> <p>control temperature ;  control other named factor (sex of fish, oxygen, age, food, tank volume) ;</p> <p>safety precaution / ethical treatment of fish ;</p>	5	

Question	Answer	Marks	Guidance
3(a)	<p><i>Any six of:</i></p> <p>light blocked ;  less photosynthesis ;  reduces productivity of, phytoplankton / producer / plants/ algae ;  less food / energy, for, food web / consumers ;  less, carbon dioxide /oxygen, dissolution ;  less respiration ;  toxicity of oil ;  bioaccumulation in food chains / <b>AW</b> ;  (which) harms, top / apex, predators ;</p>	6	
3(b)	<p><i>Any six of:</i></p> <p>mangroves / seagrass, are habitats for species / shelter / protection from predators ;</p> <p>loss of breeding areas ;  (so) less reproduction / populations decrease ;</p> <p>loss of nursery grounds ;</p> <p>seagrass stabilises the seabed / <b>AW</b> ;  mangroves stabilise the coast / <b>AW</b> ;  turbidity could increase ;  coastal erosion could increase / lack of protection against waves ;</p> <p>mangroves provide nesting sites for birds ;</p> <p>mangroves / seagrass, are carbon sinks ;  (so loss of could cause) increase in levels of dissolved carbon dioxide ;</p> <p>decay of dead plant material ;  less oxygen (from less photosynthesis or due to decay) ;  so less respiration (of organisms) ;</p>	6	<p><b>A</b> named examples of species</p>

Question	Answer	Marks	Guidance
3(c)	<p><i>Any three of:</i></p> <p>bacteria ;            (may be) genetically engineered ;            (to) digest oil ;            into harmless products ;            addition of minerals (to increase bacteria) ;</p>	<b>3</b>	

Question	Answer	Marks	Guidance
4(a)	preventing extinction of species / maintaining a habitat / protection of endangered species / <b>AW</b> ;	<b>1</b>	
4(b)(i)	<p><i>Any five of:</i></p> <p>place adult clams into (sterile), tanks / concrete ponds / brood-stock tanks / <b>AW</b> ;            place gonad into water / introduce SIS ;            to stimulate gamete release ;</p> <p>fertilisation occurs / spats form ;            transfer, spats / juveniles, to cages / tanks ;</p> <p>add, fertilisers / minerals ;            (to grow) phytoplankton food / feed with phytoplankton ;            illuminate / provide light ;            maintain temperature / oxygen / aerate ;</p> <p>transfer to, cages / trays / <b>AW</b>, in (open) sea ;</p> <p>monitor for disease / harvest when reach market size ;</p>	<b>5</b>	

Question	Answer	Marks	Guidance
4(b)(ii)	<p><i>Any four of:</i></p> <p>overpopulation ; due to releasing too many clams / insufficient predation ;</p> <p>affecting, food webs / chains / reducing wild clam population ; due to, over competition for food / predation / space / <b>AW</b> ;</p> <p>disease spread ; due to, viral / fungal / bacterial / microbes, infections from culture ;</p> <p>affecting gene pools ; due to breeding with 'wild' clam ;</p> <p>not surviving ; due to poor genetic quality / lack of adaptations / <b>AW</b> ;</p>	<b>4</b>	max 3 for ideas only
4(c)	<p><i>Any five of:</i></p> <p>water, salinity / potential is the same as body fluids ; salinity is not controlled / cannot control internal salinity / cannot osmoregulate / <b>AW</b> ;</p> <p>in, low salinity / freshwater, water is gained into the, organism / cells / tissues ; by osmosis ; so cells / tissues expand / burst / <b>AW</b> ;</p> <p>in high salinity water is lost from the organism / cells / tissues ; by osmosis ; cells / tissues shrink / <b>AW</b> ;</p>	<b>5</b>	<b>A</b> osmosis only once