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**MARINE SCIENCE**

**9693/02**

Paper 2 Data Handling and Free-Response

**October/November 2017**

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.

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Question	Answer	Marks	Guidance																		
1(a)	<table border="1"> <thead> <tr> <th>number (<math>n</math>)</th> <th><math>n(n-1)</math></th> </tr> </thead> <tbody> <tr> <td>7</td> <td>42</td> </tr> <tr> <td>16</td> <td>240</td> </tr> <tr> <td>11</td> <td>110</td> </tr> <tr> <td>23</td> <td>506</td> </tr> <tr> <td>14</td> <td>182</td> </tr> <tr> <td>3</td> <td>6</td> </tr> <tr> <td>5</td> <td>20 ;</td> </tr> <tr> <td>Total (<math>N</math>) = 79 ;</td> <td><math>\Sigma n(n-1) = 1106</math> ;</td> </tr> </tbody> </table>	number ( $n$ )	$n(n-1)$	7	42	16	240	11	110	23	506	14	182	3	6	5	20 ;	Total ( $N$ ) = 79 ;	$\Sigma n(n-1) = 1106$ ;	3	all values of $n(n-1)$ correct for 1 mark
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7	42																				
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Total ( $N$ ) = 79 ;	$\Sigma n(n-1) = 1106$ ;																				
1(b)	<p>figures correctly substituted into formula ; <math>79 \times 78 / 1106</math></p> <p>diversity index for shore B = 5.6 ;</p>	2	A ECF from 1(a)																		
1(c)	<p>any 3 of:</p> <p>shore B has a higher biodiversity than shore A ;</p> <p>both shores have the same (7) number of species present / same species richness ;</p> <p>idea that shore B has higher populations of each species than shore A ;</p> <p>total number of organisms greater at shore B / shore B has 29 more organisms ;</p>	3																			

Question	Answer	Marks	Guidance
1(d)	<p><i>any 2 of:</i></p> <p>type / location, of shore ;</p> <p>height / position, on shore ;</p> <p>sampling area ;</p> <p>time of year ;</p> <p>state of the tide ;</p> <p>abiotic factor ;</p>	2	

Question	Answer	Marks	Guidance
2(a)	<p>appropriate linear <b>scale</b> for both axes ;</p> <p>both <b>axes</b> labelled including units ;</p> <p>all points <b>plotted</b> correctly (<math>\pm \frac{1}{2}</math> small square) ;</p> <p>points joined with ruled <b>lines</b> ;</p>	4	plots to cover at least half of the grid
2(b)	<p>as temperature increases, concentration of dissolved oxygen decreases ;</p> <p>use of manipulated figures ;</p>	2	
2(c)(i)	concentration of dissolved oxygen decreases ;	1	
2(c)(ii)	concentration of dissolved oxygen increases ;	1	
2(d)	<p>more, photosynthesis / producers / productivity ;</p> <p>due to, wave action / turbulence ;</p>	2	

Question	Answer	Marks	Guidance
3(a)(i)	all the different, species of organisms / populations ; in a particular, habitat / ecosystem, at the same time ;	2	
3(a)(ii)	rate ; at which, organic material / biomass, is produced ;	2	
3(b)	<p>any 5 of:</p> <ol style="list-style-type: none"> <li>1 sandy shores are unstable / continuously shifting / longshore drift / <b>AW</b> ;</li> <li>2 subject to <u>erosion</u> ;</li> <li>3 <u>sand</u> has a high porosity / dries out quickly / <b>AW</b> ;</li> <li>4 lack of suitable substrate for attachment ;</li> <li>5 no / few, producers for food / lack of photosynthesis / low primary productivity ;</li> <li>6 no shelter / exposure to predators ;</li> <li>7 only burrowing animals can live there / idea of, only a small number of species are adapted to live there ;</li> <li>8 few niches available ;</li> </ol>	5	

Question	Answer	Marks	Guidance
3(c)	<p><i>any 6 of:</i></p> <p>1 reefs, dissipate / reduce, wave <u>energy</u> ;</p> <p>2 slow down / reduce, wave action ;</p> <p>3 protect shores from flooding ;</p> <p>4 reduce coastal erosion ;</p> <p>5 provide protection for (named) coastal habitats ;</p> <p>6 provide protection for coastal, properties / infrastructure ;</p> <p>7 idea of providing safe anchorages ;</p>	6	

Question	Answer	Marks	Guidance
4(a)	<p><i>any 3 of:</i></p> <p>increased evaporation in lagoon ;</p> <p>due to high temperature ;</p> <p>increasing concentration of salt which increases salinity ;</p> <p>idea of, <u>dilution</u> of sea water in an estuary / decrease in concentration of salt ;</p> <p>by <u>fresh water</u> from, rivers / run off, decreases salinity ;</p>	3	
4(b)	<p><i>any 2 of:</i></p> <p>force caused by rotation of the Earth ;</p> <p>idea of <u>deflection</u> of, ocean currents / cyclones / wind direction ;</p> <p>ref. to different direction of spin in northern and southern hemisphere / wind or currents have spiral patterns away from the equator ;</p>	2	

Question	Answer	Marks	Guidance
4(c)	<p><i>any 5 of:</i>  decrease in temperature of water at surface ;    <i>(leads to upwelling)</i>  increase in density ;  cold / more dense, water sinks ;  replaced by water moving up from below / <b>AW</b> ;  ref. to convection ;  surface currents are driven by the wind ;  surface water moved away from coasts ;  ref. to (wind driven) currents deflected by underwater ridges causing them to move upwards ;  ref. to global conveyer belt / deep water currents, being temperature driven / start at the poles ;</p>	<b>5</b>	

Question	Answer	Marks	Guidance
4(d)	<p><i>any 5 of:</i></p> <ol style="list-style-type: none"><li>1 carbon / carbon dioxide, used to synthesise organic compounds / absorbed by producers / for photosynthesis ;</li><li>2 magnesium for chlorophyll ;</li><li>3 phosphorus for, DNA / bones ;</li><li>4 nitrogen for, amino acids / proteins / DNA ;</li><li>5 calcium for, bones / teeth / skeleton ;</li><li>6 nutrients are incorporated into food chains ;</li><li>7 (loss by) harvesting ;</li><li>8 (loss by) dead organisms / faeces, sinking to sea floor ;</li><li>9 (loss by) incorporation into coral reefs ;</li></ol>	<b>5</b>	