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**MARINE SCIENCE**

**9693/01**

Paper 1 AS Structured Questions

**May/June 2017**

MARK SCHEME

Maximum Mark: 75

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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.

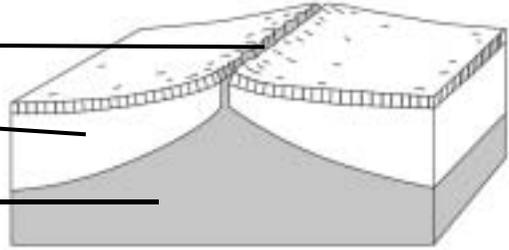
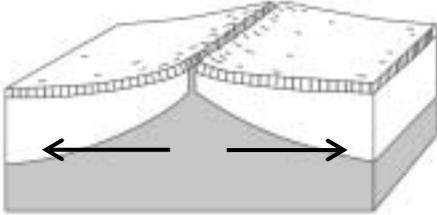
Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This mark scheme will use the following abbreviations:

<b>;</b>	separates marking points
<b>/</b>	separates alternatives within a marking point
<b>()</b>	contents of brackets are not required but should be implied / the contents set the context of the answer
<b>R</b>	reject
<b>A</b>	accept (answers that are correctly cued by the question or guidance you have received)
<b>I</b>	ignore (mark as if this material was not present)
<b>AW</b>	alternative wording (where responses vary more than usual, accept other ways of expressing the same idea)
<b>AVP</b>	alternative valid point (where a greater than usual variety of responses is expected)
<b>ORA</b>	or reverse argument
<b><u>underline</u></b>	actual word underlined must be used by the candidate (grammatical variants excepted)
<b>MAX</b>	indicates the maximum number of marks that can be awarded
<b>+</b>	statements on both sides of the + are needed for that mark
<b>OR</b>	separates two different routes to a mark point and only one should be awarded
<b>ECF</b>	error carried forward (credit an operation from a previous incorrect response)

Question	Answer	Marks	Guidance								
1(a)(i)	mid-ocean ridge ;  tectonic plate ; magma ;	<b>3</b>									
1(a)(ii)	two arrows pointing in opposite directions, away from each other ; 	<b>1</b>									
1(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">feature</th> <th style="width: 50%; text-align: center;">type of plate boundary</th> </tr> </thead> <tbody> <tr> <td>ocean trench</td> <td>convergent</td> </tr> <tr> <td>volcano</td> <td>convergent / divergent</td> </tr> <tr> <td>hydrothermal vents</td> <td>divergent</td> </tr> </tbody> </table>	feature	type of plate boundary	ocean trench	convergent	volcano	convergent / divergent	hydrothermal vents	divergent	<b>2</b>	3 correct = 2 1 or 2 correct = 1
feature	type of plate boundary										
ocean trench	convergent										
volcano	convergent / divergent										
hydrothermal vents	divergent										

Question	Answer	Marks	Guidance				
1(c)(i)	<p><i>any 4 of:</i></p> <p>ref. to convergent plate boundary (or description of) ;</p> <p>idea of, pressure build-up ;</p> <p>earthquake <b>or</b> <u>sudden</u> slippage of plate ;</p> <p>release of energy ;</p> <p><u>large volume</u> of water displaced ;</p>	<b>4</b>					
1(c)(ii)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" data-bbox="331 655 1339 703" style="text-align: center;"><b>OR</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="331 703 837 1155" style="width: 50%; vertical-align: top;"> <p>convergent plates / subduction zone / description ;</p> <p>reference to pressure builds up / release ;</p> <p>thin earth's crust ;</p> <p>hot gases / molten rock / lava / magma + rises / erupts ;</p> <p><u>lava</u> cools / solidifies / hardens to form rock ;</p> </td> <td data-bbox="837 703 1339 1155" style="width: 50%; vertical-align: top;"> <p>divergent plates / description ;</p> <p>hot gases / molten rock / lava / magma + rises / erupts ;</p> <p><u>lava</u> cools / solidifies / hardens to form rock ;</p> </td> </tr> </tbody> </table>	<b>OR</b>		<p>convergent plates / subduction zone / description ;</p> <p>reference to pressure builds up / release ;</p> <p>thin earth's crust ;</p> <p>hot gases / molten rock / lava / magma + rises / erupts ;</p> <p><u>lava</u> cools / solidifies / hardens to form rock ;</p>	<p>divergent plates / description ;</p> <p>hot gases / molten rock / lava / magma + rises / erupts ;</p> <p><u>lava</u> cools / solidifies / hardens to form rock ;</p>	<b>4</b>	
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Question	Answer	Marks	Guidance
2(a)(i)	zooxanthellae ;	1	A dinoflagellate
2(a)(ii)	<i>any 3 of:</i> algae photosynthesise ; produce oxygen / glucose / sugars / carbohydrates / organic compounds / amino acids for coral ; corals provide protection for algae ; corals provide carbon dioxide for algae ;	3	I food / nutrients  A minerals
2(b)	<i>any 3 of:</i> idea of, as depth increases, light decreases ; idea of, as sediment increases, light decreases ; sediment blocks / smothers polyps ; need <u>light</u> for photosynthesis ;	3	ORA  ORA  A idea of, abrasive action of sediment eroding coral

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Question	Answer	Marks	Guidance
2(c)(i)	<p><i>any 2 of:</i></p> <p><u>all</u> areas show increase in threatened area ;</p> <p>SE Asia has greatest total area threatened ;</p> <p>Atlantic region has least total area threatened ;</p> <p>Australia has lowest percentage reef area threatened in 2011 ;</p> <p>SE Asia has highest percentage reef area threatened (in 2011) ;</p> <p>Australia has biggest change / increase (in percentage) of reef area threatened ;</p> <p>SE Asia has the least change / increase in percentage of reef area threatened ;</p> <p>Atlantic and Australia have the same percentage of reef area threatened in 2030 ;</p> <p>SE Asia has the highest percentage reef area threatened in 2030 ;</p> <p>SE Asia has the largest total reef area ;</p> <p>Atlantic has the smallest total reef area ;</p> <p>appropriate manipulation of figures ;</p>	<b>2</b>	<p><b>I</b> data quotes, <b>must</b> be manipulated</p>

Question	Answer	Marks	Guidance
2(c)(ii)	<p><i>any 2 of:</i></p> <p>idea of, increase in storm damage / stronger, storms / storm waves ;</p> <p>less protection for beaches / coastal areas ;</p> <p>increased flooding ;</p> <p>increased erosion ;</p> <p>(leading to) damage to crops ;</p> <p>damage to buildings / infrastructure ;</p> <p>decrease (in revenue) from tourism ;</p> <p>decrease (in revenue) from harvesting / fishing ;</p>	2	

Question	Answer	Marks	Guidance
3(a)	<p>Ions / <u>dissolved salts</u> ;</p> <p><i>any 1 of:</i></p> <p>(total) mass ;</p> <p><b>OR</b></p> <p>in a unit volume of water / parts per thousand ;</p> <p><b>OR</b></p> <p>concentration ;</p>	2	A quantity
3(b)(i)	<p>1.0260 ;</p> <p><math>\text{g cm}^3</math> ;</p>	2	A $\text{g / cm}^3$ , g per $\text{cm}^3$

Question	Answer	Marks	Guidance
3(b)(ii)	as temperature increases density, decreases / <b>ORA</b> ; as salinity increases density, increases / <b>ORA</b> ;	<b>2</b>	
3(c)	<i>any 2 of:</i> evaporation ; <u>salt-rich</u> run off from land / weathering of rocks ; formation of sea ice ; upwelling ; reduction in fresh water input ;	<b>2</b>	

Question	Answer	Marks	Guidance
4(a)(i)	height ; m / metres ;	<b>2</b>	
4(a)(ii)	12 ;	<b>1</b>	
4(a)(iii)	C ;	<b>1</b>	
4(a)(iv)	lower peaks for high tide ; line shown for <u>all</u> of graph ;	<b>2</b>	

Question	Answer	Marks	Guidance
4(b)	<p><i>any 3 of:</i></p> <p>when they / Moon and Sun (and Earth), form a line / are <u>in</u> alignment / are aligned;</p> <p>the tidal range is at its maximum (greater, greatest) / spring tide ; when Sun and Moon are perpendicular / at 90° ;</p> <p>(to one another) the tidal range is reduced (smaller, smallest) / neap tide ;</p> <p>reference to the influence of gravity by Sun and / or Moon ;</p>	<b>3</b>	<b>A</b> labelled diagram

Question	Answer	Marks	Guidance
5(a)	<p>fall in population of crabs ;</p> <p>+ <i>any pair of</i>, reduction in populations of small fish / sea snails / sea urchins / sea stars / primary consumers ; less food available for crabs ; <b>OR</b> less photosynthesis; less energy passed along food chain ; <b>OR</b> loss of crab hiding places / habitat ; increased predation of crabs ; <b>OR</b> less sea urchins / sea stars (for otters) ; increased predation of crabs (by otters) ;</p> <p>no change in crab population ; <b>+</b> as feed (more) on other species ; such as filter feeders / juvenile fish ;</p>	<b>3</b>	
5(b)	<p>5 levels + names ;</p> <p>rectangular boxes centred on each other, largest at bottom ;</p>	<b>2</b>	
5(c)(i)	<p><i>any 3 of:</i> idea of, some is <u>reflected</u> ;</p> <p>some is absorbed by the water <b>OR</b> blocked by, objects / sediment ;</p> <p>some wavelengths / colours are unsuitable (for photosynthesis) ;</p> <p>some does not hit chlorophyll / chloroplast ;</p> <p>photosynthesis is not (100%) efficient ;</p>	<b>3</b>	

<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
5(c)(ii)	25 ;	<b>1</b>	
5(d)	<i>any 4 of:</i> idea of, more nutrients available / nutrients brought up ; increased photosynthesis ; increased growth ; by producers / algae / kelp / phytoplankton ; more food / energy for other organisms ;	<b>4</b>	

<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
6(a)(i)	make proteins / amino acids / DNA / RNA / ATP / hormones / enzymes / lignin;	<b>1</b>	
6(a)(ii)	make organic materials / named organic materials ;	<b>1</b>	
6(a)(iii)	make DNA / RNA / bones / ATP / phospholipid membrane ;	<b>1</b>	
6(a)(iv)	make chlorophyll ;	<b>1</b>	
6(b)(i)	<i>any 2 of:</i> ref. to weathering / erosion ; dissolved (in water) ; runoff (to sea) ;	<b>2</b>	
6(b)(ii)	<i>any 2 of:</i> death of organisms / uneaten / undigested parts ; ref. to decay / decomposition ; sinking (to the sea bed) ;	<b>2</b>	
6(b)(iii)	<i>any 2 of:</i> calcium present in marine organisms ; (permanently) removed (by fishing / harvesting) ; less calcium in the cycle / less calcium to be recycled ;	<b>2</b>	

Question	Answer	Marks	Guidance
7(a)	the role of an organism in an ecosystem ;	1	
7(b)(i)	increasing ; due to large population of prey ;	2	
7(b)(ii)	reaches a peak, then falls ; initially plenty of food + then prey population declines ; <b>OR</b> ref. to time lag between drop in prey and predator populations ;	2	
7(c)	both lines decrease ; predator population lags behind prey ;	2	
7(d)(i)	<i>any 1 of:</i> takes time to find suitable food / shelter / mates ; low numbers reproducing, therefore low rate (until get larger number of reproductive individuals) ; stress from habitat change ;	1	
7(d)(ii)	line decreasing from time point <b>M</b> ;	1	<b>A</b> plateau then decrease
7(d)(iii)	<i>any 1 of:</i> disease ; change in food availability ; <b>AVP</b> ;	1	e.g. ref. to a change in, salinity / acidity / temperature climate change / lack of suitable nesting sites / habitat loss / environmental stress / adverse weather or example of