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**MARINE SCIENCE**

**9693/01**

Paper 1 AS Structured Questions

**May/June 2016**

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.

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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)

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>1 (a) (i)</b>	4.8 ; thousand tonnes (per year) ;	<b>A</b> 4800 tonnes (2)	[2]
<b>(ii)</b>	<i>((predator) species A, (prey) species B)</i>  1. predator / species <b>A</b> has lower <u>total mass</u> than prey / species <b>B</b> ;  2. ref. to time factor ;  3. appropriate trend to support decision + use of data ;	  e.g. later / after / lag / next  exact location from the graph must be clear	[3]
<b>(b) (i)</b>	<i>any 3 of:</i> 1. (general) decrease in <b>both</b> ;  2. predated mass gradient steeper ;  3. ref. second peak for <b>both</b> in 1996 <b>OR both</b> increase from 1992 to ,1995 / 1996 ;  4. mass predated (always) greater than mass of adults / <b>ORA</b> ;  5. manipulation of data ;	        e.g. overall decrease in mass of cod predated is 300 thousand tonnes	[3]

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>(ii)</b>	<p><i>any 2 of:</i></p> <ol style="list-style-type: none"> <li>1. overfishing / catch <u>too many</u> fish ;</li> <li>2. disease / (increase in) natural predation / lack of food / environmental effect ;</li> <li>3. less adult fish to reproduce ;</li> <li>4. less juveniles to mature ;</li> <li>5. to compensate for / replace those adults removed by fishing ;</li> </ol>	<b>A</b> ref. to harvesting juveniles	[2]
			<b>[Total: 10]</b>
<b>2 (a) (i)</b>	<p><i>any 2 of:</i></p> <p>high temperature / (very) hot ;</p> <p>acidic / low pH ;</p> <p>high pressure / a lot of pressure ;</p> <p>dark / lack of light ;</p> <p>(high) level of minerals or named example ;</p>	<b>A</b> emits hydrogen sulfide / sulfuric acid / H <sub>2</sub> SO <sub>4</sub> formed	[2]

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>(ii)</b>	<i>any 3 of:</i> 1. (location) plate boundaries / description ; 2. (cold sea) water enters cracks in sea floor / <b>AW</b> ; 3. heated by, + magma / mantle ; 4. (hot water) dissolves / picks up minerals / named example ; 5. idea of, (this is) <u>forced</u> up / out (of sea bed / crust) ; 6. (dissolved minerals) precipitate / solidify ;		[3]
<b>(b) (i)</b>	hydrogen sulfide / H <sub>2</sub> S <b>OR</b> methane / CH <sub>4</sub> <b>OR</b> dissolved minerals <b>OR</b> hydrogen / H <sub>2</sub> ;		[1]
<b>(ii)</b>	mutualistic bacteria + vent bacteria ;		[1]
<b>(iii)</b>	(vent bacteria) → zooplankton → (galatheid) crab → ratfish ; ;	1 mark for sequence of all organisms, 1 mark for arrows <b>R</b> additional arrows	[2]

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Question	Expected answers	Additional guidance	Marks
(iv)	<p>any 3 of:</p> <ol style="list-style-type: none"> <li>(location) live in, <i>Riftia</i> / clams / mussels / Pompeii worms, tissues / cells ;</li> <li>(function) produce food / organic material ;</li> <li>(process) from chemosynthesis / description of ;</li> <li>(use) used by, <i>Riftia</i> / clams / mussels / Pompeii worms / rest of food chain / other trophic levels <b>OR</b> as energy / nutrient / food source ;</li> </ol>	<p><b>A</b> sugars / carbohydrates <b>OR</b> acts as a primary producer</p> <p><b>A</b> symbol or word equation as description</p>	[3]
			<b>[Total: 12]</b>
3 (a) (i)	<p>any 3 of:</p> <ol style="list-style-type: none"> <li>(high level of oxygen at surface) due to mixing with air / ref. to wind / turbulence / dissolution ;</li> <li>light intensity / light availability at surface / in the photic zone ;</li> <li><u>photosynthesis</u> ;</li> <li>(oxygen given out) by phytoplankton / algae / producers ;</li> </ol>		[3]

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>(ii)</b>	<p><i>any 2 of:</i> (fall with depth due to)</p> <ol style="list-style-type: none"> <li>oxygen used up, by animals / fish / in decomposition / in respiration ;</li> <li><u>no</u> light at this depth ;</li> <li>so <u>no</u> , photosynthesis / plants (to release oxygen) ;</li> </ol>	<p><b>A</b> beneath / below photic zone</p> <p><b>A</b> as another mark point, ref. to / description of compensation point ;</p>	[2]
<b>(b) (i)</b>	<p><i>any 2 of:</i> bones / exoskeletons ;</p> <p>teeth ;</p> <p>DNA / RNA / nucleic acids ;</p> <p>cell membranes / phospholipids ;</p> <p>ATP / energy transfer ;</p>		[2]
<b>(ii)</b>	<p><i>any 3 of:</i></p> <ol style="list-style-type: none"> <li>taken up by, plants / producers / animals / organisms ;</li> <li>ref. food chain / <b>AW</b> ;</li> <li>organisms / plants / producers / animals, die / decay / decompose, <b>OR</b> egestion / excretion ;</li> <li>(organisms / excretory products) sink to bottom ;</li> </ol>		[3]
			<b>[Total: 10]</b>

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>4 (a) (i)</b>	strong winds / strong currents / strong waves / <b>AW</b> + physical damage to coral / reef / e.g. parts broken off / coral ripped up <b>OR</b> (stirred up) sediment has abrasive action (erodes coral / reef) ;		[1]
<b>(ii)</b>	<i>any 2 of :</i> 1. zooxanthellae / algae leave coral tissues / coral bleaching ; 2. (leading to) lack of food / reduction in photosynthesis ; 3. growth rate of coral reduced / coral weakened / die ;		[2]
<b>(iii)</b>	<i>any 3 of:</i> 1. light blocked + (going to the ) zooxanthellae / algae ; 2. (leading to) lack food / reduction in photosynthesis ; 3. corals unable to feed due to mouth blockage ; 4. growth rate of coral reduced / coral weakened / die ; 5. idea of, abrasive action (erodes coral / reef) ;		[3]
<b>(b) (i)</b>	as carbon dioxide increases, growth rate decreases / <b>AW</b> / <b>ORA</b> ;		[1]
<b>(ii)</b>	carbon dioxide dissolves in / reacts with (sea) water / (atmospheric) dissolution ;  forms (carbonic) acid / lowers pH ;  prevents skeleton formation / dissolves skeleton ;	<b>not</b> mixing (in terms of CO <sub>2</sub> getting into the water)  <b>A</b> correct formula	[3]
			<b>[Total: 10]</b>



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Question	Expected answers	Additional guidance	Marks
5 (a)	<p><i>any 2 of:</i></p> <ol style="list-style-type: none"> <li>idea of, continuous / constant movement (of water) / <b>AW</b> ;</li> <li>ref. to direction / e.g. east to west ;</li> <li>ref. to <u>deep</u> ocean currents <b>OR</b> <u>surface</u> currents <b>OR</b> vertical / horizontal currents ;</li> </ol>	I refs. to tides	[2]
(b)	<p><i>any 3 of:</i></p> <p>wind <b>OR</b> differences in atmospheric / air pressure ;</p> <p>temperature ;</p> <p>density ;</p> <p>salinity ;</p> <p>Coriolis effect / description of ;</p> <p>shape of sea bed ;</p>		[3]
(c)	<p><i>any 4 of:</i></p> <ol style="list-style-type: none"> <li><u>offshore</u> winds;</li> <li>wind moves water across <u>surface</u> / moves <u>surface</u> water;</li> <li>creates area of low pressure ;</li> <li>(for) water to move up / rise to surface / top ;</li> <li>idea of, to replace displaced water / filling area of low pressure ;</li> </ol>	<b>A</b> all points on an <b>annotated</b> diagram	[4]
			<b>[Total: 9]</b>

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Question	Expected answers	Additional guidance	Marks
6 (a) (i)	<p>any 2 of:</p> <ol style="list-style-type: none"> <li>captures/traps/absorbs/uses, <u>light</u> (energy) (from Sun) ;</li> <li>converts (light energy) to chemical energy ;</li> <li>idea of, (energy) <u>passed</u> through/along/up food chain/web (makes it) available for next level of food chain ;</li> </ol>	<p>I Sun's energy</p> <p>A (energy stored in) carbohydrates/glucose/organic compounds</p>	[2]
(ii)	<p>(feeding) position/level + in a food chain/food web ;</p> <p>named example from the food chain ;</p>	e.g. diatoms at level 1	[2]
(b) (i)	<p>1100/7000 × 100</p> <p>15.7 ; ;</p>	correct answer=2 marks, even if no working shown	[2]
(ii)	<ol style="list-style-type: none"> <li>energy lost in, excretion/urine/waste products/egestion/faeces ;</li> <li>energy lost in parts not eaten ;</li> <li>e.g. tuna much bigger than shrimp, so more likely to consume whole organism/all available energy taken in ; ; <i>NOTE 2 MARKS</i></li> <li>e.g. marlin only eat parts of tuna so some energy lost ; ; <i>NOTE 2 MARKS</i></li> </ol>	<p>max 3 marks if no attempt to EXPLAIN the differences and therefore efficiency (TLTE) between trophic levels in this marine food chain e.g., MPTs. 3, 4, 6 , 8</p> <p>2 marks awarded for this MP as MP2 is clearly implied in this statement and they have attempted an explanation (do not also credit MP2)</p> <p>2 marks awarded for this MP as MP2 is clearly implied in this statement and they have attempted an explanation (do not also credit MP2)</p>	

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Question	Expected answers	Additional guidance	Marks
	<p>5 energy lost in indigestible material ;</p> <p>6 e.g. shrimps eat diatoms (which are silicates) and have a lot of indigestible material/harder to digest ; ; <i>NOTE 2 MARKS</i></p> <p>7 some energy lost in movement ;</p> <p>8 e.g. tuna fast moving, therefore marlin has to expend more energy to catch ; ; <i>NOTE 2 MARKS</i></p> <p>9 some energy lost in respiration/as heat ;</p> <p>10 <b>AVP</b> ;</p>	<p>2 marks awarded for this MP as MP5 is clearly implied in this statement and they have attempted an explanation (do not also credit MP5)</p> <p>2 marks awarded for this MP as MP7 is clearly implied in this statement and they have attempted an explanation (do not also credit MP7)</p> <p>Example of AVP is when the candidate demonstrates a direct and clear understanding of the link between energy loss and reduction in TLTE e.g. 'all of the energy losses mean that the TLTE values for that transfer will be less'</p> <p>'energy losses affect the TLTE' is too vague</p>	[4]
			<b>[Total: 10]</b>

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7 (a)	<p><i>any 3 of:</i></p> <ol style="list-style-type: none"> <li>1. nutrients present in or used by marine organisms / named e.g. / food chains / <b>AW</b> ;</li> <li>2. removed by humans by harvesting marine organisms ;</li> <li>3. less decay takes place to release nutrients ;</li> <li>4. nutrients not replenished / recycled ;</li> <li>5. idea of, reduction in amount of runoff ;</li> <li>6. idea of, more fertiliser leads to algal blooms ;</li> <li>7. (algal blooms then) use up nutrients ;</li> </ol>	<p><b>A</b> idea of, remove nutrients forever</p>	[3]
(b) (i)	<p><i>any 2 of:</i></p> <ol style="list-style-type: none"> <li>1. (runoff) carries toxic / poisonous (chemicals / waste) / chemicals which can kill ;</li> <li>2. ref. leading to bioaccumulation / description of ;</li> <li>3. ref. to causing algal blooms ;</li> <li>4. ref. to (run off) carries / causes increase in, sediment, which reduces photosynthesis / light penetration ;</li> </ol>	<p><b>I</b> pesticide / fertiliser unless qualified with toxic / poisonous <b>I</b> harmful</p>	[2]

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(ii)	<i>any 2 of:</i> <ol style="list-style-type: none"> <li>contains / provides / replenishes / replaces + nitrates / phosphates / magnesium / carbon / calcium ;</li> <li>taken up by organisms / into food chain ;</li> <li>ref. increased growth / productivity ;</li> </ol>		[2]
			<b>[Total: 7]</b>
8 (a) (i)	<i>any 2 of:</i> <ol style="list-style-type: none"> <li>ref. to negative / disruptive effect on food chain / webs / description of ;</li> <li>(leads to) ref. to reduced biodiversity ;</li> <li>reduction in fish size / ages <b>OR</b> less adult fish to reproduce ;</li> <li>ref. to cyanide fishing is indiscriminate ;</li> <li>damage to coral reef + method (e.g. by blast fishing / anchors / nets dragged along sea bed / dredging / trawling ;</li> </ol>	e.g. removes fish that feed on algae causing excess algal growth leading to ecological imbalance.	[2]
(ii)	<i>any 2 of:</i> <ol style="list-style-type: none"> <li>act as breakwater ;</li> <li>reduces wave action / slow down waves ;</li> <li>(coral reefs) dissipate / reduce / absorb wave <u>energy</u> ;</li> <li>reduce current speed ;</li> </ol>	<b>AW</b> e.g. barrier, buffer  <b>I</b> stop	[2]

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(b)	<p><i>any 3 of:</i></p> <ol style="list-style-type: none"> <li>1. low risk has decreased ;</li> <li>2. low risk greatest % change ;</li> <li>3. medium risk has decreased slightly <b>OR</b> similar / same values ;</li> <li>4. high + very high have increased ;</li> <li>5. critical only appears in 2030 / there are more categories in 2030 ;</li> <li>6. correct <u>manipulation</u> of data ;</li> </ol>	<p><b>A</b> for MP1 the alternative idea that over all, there are more reefs at risk / increase in risk in 2030</p> <p>e.g., very high has doubled = MP6 low risk has decreased by <math>\times 6 = 2</math> marks MP1 and 6</p>	[3]
			<b>[Total: 7]</b>