

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

## **MARK SCHEME for the May/June 2015 series**

### **9693 MARINE SCIENCE**

**9693/03**

Paper 3 (A2 Structured Questions), maximum raw mark 75

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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Mark schemes will use these abbreviations:

<b>;</b>	separates marking points
<b>/</b>	alternatives
<b>()</b>	contents of brackets are not required but should be implied
<b>R</b>	reject
<b>A</b>	accept (for answers correctly cued by the question, or guidance for examiners)
<b>lg</b>	ignore (for incorrect but irrelevant responses)
<b>AW</b>	alternative wording (where responses vary more than usual)
<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 candidate (grammatical variants excepted)
<b>max</b>	indicates the maximum number of marks that can be given
<b>+</b>	statements on both sides of the + are needed for that mark

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Question	Expected answers	Additional guidance	Marks
1 (a)	<p><b>temperature :</b>  photosynthesis / carbon dioxide uptake increases with temperature up to optimum / AW and then decreases ;</p> <p>ref. to enzymes ;</p> <p>ref. to increase in temperature increasing kinetic energy / more enzyme-substrate reactions / more collisions / AW ;</p> <p>ref. (to excess kinetic energy causing) loss of active site / change to shape of enzymes so unable to function / denature ;</p> <p><b>light intensity :</b>  photosynthesis / carbon dioxide uptake increases with light intensity to a maximum and then levels off ;</p> <p>ref. to light / energy being absorbed / AW by chlorophyll / chloroplasts ;</p> <p>idea of: chlorophyll becoming saturated ;</p> <p>ref. light no longer limiting / another factor is limiting ;</p> <p><b>carbon dioxide concentration :</b>  photosynthesis increases with carbon dioxide concentration (to a maximum) and then levels off ;</p> <p>ref. to carbon dioxide being used / use as a substrate ;</p> <p>idea of: (enzymes) working at maximum rate ;</p> <p>ref. carbon dioxide no longer limiting another factor is limiting ;</p>	<p><b>A</b> named factor, e.g. temperature, carbon dioxide</p> <p><b>A</b> named factor, e.g. temperature, light</p>	[9]

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Question	Expected answers	Additional guidance	Marks
(b)	<ol style="list-style-type: none"> <li>idea that most phytoplankton are near to surface / (eu)photic zone / 20 – 200 m ;</li> <li>ref. to light penetration decreases as depth increases / insufficient light for photosynthesis at depth ;</li> <li>ref. to temperature / thermoclines so temperature decreases with depth / temperature too low for enzymes / process to work ;</li> <li>ref. to low solubility of CO<sub>2</sub> in seawater / insufficient at depth ;</li> <li>ref. to more respiratory CO<sub>2</sub> in higher levels / more CO<sub>2</sub> at surface due to wave action ;</li> </ol>	R on the surface	[max 3]
			<b>[Total 12]</b>
2 (a) (i)	<ol style="list-style-type: none"> <li>osmotic concentration of sea water is higher than that of fish (blood) / sea water has lower water potential ;</li> <li>ref. to figures, e.g. sea water of 1050 au is more than salmon of 390 au / tuna 460 au ;</li> <li>water moves by osmosis ;</li> <li>from fish (blood) to seawater ;</li> <li>drinking replaces water lost ;</li> </ol>		[max 3]

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Question	Expected answers	Additional guidance	Marks
(ii)	<ol style="list-style-type: none"> <li>seawater has higher chloride concentration than fish ;</li> <li>ref. to figures for sea water and either fish ;</li> <li>seawater swallowed brings in chloride ions ;</li> <li>idea of water loss from cells / tissues if chloride concentration is too high ;</li> <li>need to remove excess taken in/to keep plasma concentration constant ;</li> </ol>	e.g. sea water contains 513 au chloride, salmon blood contains 120–138 / tuna blood 169–173.	[max 3]
(b)	<ol style="list-style-type: none"> <li>salmon spend part of their life cycle in fresh water and part in sea water/reproduce in fresh water ;</li> <li>salmon are euryhaline/tuna are stenohaline ;</li> <li>in fresh water the osmotic concentration of the blood (of both fish) is more than fresh water ;</li> <li>water enters the fish (by osmosis) and dilutes the blood ;</li> <li>chloride concentration in blood is higher than freshwater ;</li> <li>chloride ions diffuse out from fish ;</li> <li>salmon can keep osmotic concentration of blood stable/tuna unable to maintain osmotic concentration of blood ;</li> <li>salmon are able to excrete excess water through the kidneys / produce dilute urine ;</li> <li>salmon are able to actively uptake chloride from gills/reverse movement of <math>Cl^-</math> across the gills ;</li> </ol>		[max 5]
			<b>[Total 11]</b>

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Question	Expected answers	Additional guidance	Marks
3 (a) (i)	<p>need a large number of eggs and sperm ;</p> <p>many eggs are not fertilised /waste of eggs and sperm ;</p> <p>idea of a lot of energy /resources needed to produce so many eggs / sperm ;</p>		[1]
(ii)	idea that the eggs and sperm are in an enclosed space /closer proximity ;	<b>R</b> protection from predators	[1]
(iii)	<p>(grouper) higher risk of predation in the open sea ;</p> <p>ocean currents may not carry all (grouper) larvae to suitable nursery area ;</p>	<p><b>A</b> larvae of salmon protected (from predators) by nest</p> <p><b>A</b> larvae of salmon hatch in the place where they develop to juveniles / where there is food available</p>	[1]
(b)	<p>(grouper) idea that large numbers gather together in one place so fishing is very easy;</p> <p>(salmon) idea that large numbers in a river are easier to trap than individuals in the sea ;</p> <p>idea of large numbers gather to / migrate to same spawning grounds (each year) ;</p> <p>fishermen know where these are and so can catch a large number easily ;</p>		[max 2]
(c)	<p>idea that different habitats provide alternative food sources ;</p> <p>idea that reduces competition for food /alternative habitats have a greater food supply ;</p> <p>idea of adults not eating offspring ;</p>	<b>I</b> general predation	
			<b>[Total 7]</b>
4 (a) (i)	<p><math>\frac{15 \times 1440}{2}</math> ; (<b>A</b> variations)</p> <p>10 800 metres /m ;</p>		[2]

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Question	Expected answers	Additional guidance	Marks
(ii)	location ; speed or direction of movement ; position in the water column ; size of the shoal of fish ;	<b>A</b> number / quantity of fish	[1]
(b) (i)	1. (heavy) trawl drags along the sea floor and damages sea bed ; 2. ref. to damaging / killing / destroy coral ; 3. almost all organisms in its path swept into the trawl net ; 4. many non-target species caught / killed ; 5. damage ecosystem / habitats lost (that take years to recover) ; 6. stirs up sediment / silt ; 7. <i>idea that</i> (sediment) blocks / reduces light penetration, reducing photosynthesis ; 8. pollutants / toxins released and (these) re-enter food chains ;	<b>A</b> by-catch  <b>A</b> ref. to named toxins, e.g. TBC, mercury	[max 4]
(ii)	have high proportion of non-target species (by-catch) that shoal with / swim close to / feeding on the target species ;  ref. to named example of non-target species ;  idea of air breathing mammals / turtles die of suffocation / drowning ;	e.g. marine mammals / named mammals / turtles / sharks	[max 2]

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Question	Expected answers	Additional guidance	Marks
(c)	1. fish is fresher when processed / the idea of processing and storing on the factory ship ; 2. fishing boats have less distance to carry catch ; 3. fishing boats can catch more as do not need to store fish ; 4. fishing boats do not need to return to port ;	A boats can stay at sea longer	[max 2]
<b>[Total 11]</b>			
5 (a) (i)	<i>catch:</i> here is a progressive / general decrease (from year 0 – year 20) ; ref. to fluctuations ; ref. to comparative / manipulated figures for whole time period ; <i>price:</i> there is an (overall ) increase (since year 0) ; ref. to decrease in price in last 2 years / reached maximum year 17 ; ref. to comparative / manipulated figures for whole time period ;	<b>R</b> descriptions on the complete sequence  e.g. fall of 550 tonnes / 20 .7 times less across the 20 year period  e.g. increase of 540 yen per kg / 2.3 times higher price / 3.5 times higher at max.	[max 5]
(ii)	idea of supply and demand ; high availability / supply exceeds demand then lower price / <b>ORA</b>		[2]
(b) (i)	providing food to larvae / feeding algae (grown in laboratory) ; pumping water ; using (land based) tanks ;		[max 2]
(ii)	replenish oxygen ; remove waste products ; remove build-up of excess food ;	I provides food	[max 2]



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(iii)	<ol style="list-style-type: none"> <li>1. only the initial breeding stock is taken from the wild population ;</li> <li>2. no feed is removed from the environment ;</li> <li>3. retaining juveniles to become new breeding stock can provide sufficient for expansion ;</li> <li>4. <i>idea</i> that wild clams are still being harvested / cultivated clams are only providing for extra demand ;</li> </ol>		[max 2]
			<b>[Total 13]</b>
6 (a)	<p>more carbon dioxide in the air originating from fossil fuels ;</p> <p>more carbon in coral originating from fossil fuels ;</p>		[2]
(b) (i)	<p>ref. to ice core borings ;</p> <p><i>idea</i> that these borings show cyclic changes in atmospheric carbon dioxide ;</p> <p>ref. to cyclic geological changes / ice ages ;</p> <p><i>idea</i> of climate changes independent of human activity ;</p> <p>ref. to volcanic emissions / eruptions / activity ;</p> <p><i>idea</i> that these release carbon dioxide (and other greenhouse gases) ;</p> <p>ref. to variation in sunspots / solar activity / solar flares ;</p> <p><i>idea</i> that sunspots cause warming of the atmosphere ;</p>		[max 4]

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Question	Expected answers	Additional guidance	Marks
(c)	<ol style="list-style-type: none"> <li>1. heat retention by water increases ocean temperature ;</li> <li>2. reduces gas/named gas solubility;</li> <li>3. causes coral bleaching/kills coral polyps/kill zooxanthellae ;</li> <li>4. loss of coral reduces habitats (for fish/crabs/sponges) ;</li> <li>5. ref. to loss of biodiversity in named marine habitat, e.g. coral ;</li> <li>6. ref. to less coral/mangrove forests protecting coastal regions ;</li> <li>7. rise in sea level will cause loss of low lying land/coral islands/coral reefs ;</li> <li>8. loss of land reduces living space / agricultural land ;</li> <li>9. (loss of ice/glaciers/snow cover) leads to less heat reflected/more heat absorbed (by land or ocean) ;</li> <li>10. (loss of ice/glaciers/snow cover) causes loss of habitat for some species e.g. polar bear ;</li> </ol>	<p>I less oxygen/carbon dioxide</p> <p><b>A</b> named examples e.g. Maldives, Bangladesh</p> <p><b>A</b> idea of many people without homes / food ;</p> <p><b>A</b> extinction of some species due to habitat loss</p>	[max 5]
			<b>[Total 11]</b>

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Question	Expected answers	Additional guidance	Marks
7 (a) (i)	<ol style="list-style-type: none"> <li>1. damage by boats/ divers, e.g. by anchors, propellers, benthic trawling, etc. ;</li> <li>2. un-licenced fishing in the reef ;</li> <li>3. dynamite /cyanide fishing ;</li> <li>4. coral blasting (for building materials) ;</li> <li>5. (illegally) collecting coral for tourist souvenirs /jewellery ;</li> <li>6. pollution of water from poorly controlled coastal development ;</li> <li>7. pollution from (unregulated) motor engines in boats /cruise ship waste /antifouling paints ;</li> </ol>	<p>e.g. sewage, industrial wastes, agricultural wastes, fertilisers, pesticides, toxins, waste (soil) from building development, litter /refuse</p>	[max 3]
(ii)	<p>idea of controlling /regulating the activities in the protected zone ;</p> <p>idea of patrols /enforcement of regulations ;</p>	<p><i>answers should be in the context of the existence of regulations about access to a protected zone, which are enforced by active engagement of people.</i></p> <p><b>A</b> e.g. restricting dive sites /limiting number or size of boats /licencing of boats or providers of recreational activities</p> <p><b>A</b> e.g. coast guard /local volunteer groups /surveillance (by satellite)</p>	[2]

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Question	Expected answers	Additional guidance	Marks
(b)	<ol style="list-style-type: none"> <li>1. idea of type/ size frequency of tourist boats allowed ;</li> <li>2. idea that marine recreation tourism want to use large boats to make more money/ bring in as many people as possible, marine protection area wants to limit number/ size to reduce pollution or over exposure of reefs ;</li> <li>3. idea of recreational fishing limits ;</li> <li>4. idea that marine recreation tourism want to use boats that take out a number of fishermen and target large fish/ use night fishing, marine protection area wants to limit number of fishermen/ number of fish caught to protect population ;</li> <li>5. idea of restricting dive or snorkelling sites/ number of divers or snorkelers ;</li> <li>6. idea that marine recreation tourism to offer a lot of sites to attract more customers, marine protection area wants keep divers in areas that can be monitored/ limit damage to reef/ rotate a small number of dive sites to allow recovery of used sites ;</li> </ol>	<p><i>answers should be in the context of differences in opinion of access to or making use of marine resources.</i></p>	[max 2]

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Question	Expected answers	Additional guidance	Marks
(c)	<ol style="list-style-type: none"> <li>1. conservation groups may want to restrict access to marine protection zone to preserve breeding grounds/habitats they believe will be exploited ;</li> <li>2. conservation groups may want to limit fishing, affecting livelihood of local fishermen ;</li> <li>3. hotel operators want the maximum access for tourists in order to increase profits ;</li> <li>4. fishermen may want to restrict (recreational fishing) tourism to prevent too many large / market size fish being used / scaring away fish by too many people ;</li> <li>5. shop keepers may want more tourism / more people to increase sales / expand their shops ;</li> <li>6. fishermen may want to hire their ships for recreational / tourist fishing to increase their income ;</li> </ol>	<p><i>answers must be in the context of differences in opinion of using the marine resources.</i></p>	[max 3]
			<b>[Total 10]</b>