

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
Cambridge International Advanced Level

## **MARK SCHEME for the October/November 2014 series**

### **9693 MARINE SCIENCE**

**9693/04**

Paper 4 (Data-Handling and Free-Response),  
maximum raw mark 50

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Question	Expected answers	Additional guidance	Mark
1 (a)	26.8%/26.9% ;		[1]
(b)	axis labelled “species” ; linear axis labelled “percentage of total landing” ; all bars/plots correct ; all bars/plots labelled with fish names ;		[4]
(c) (i)	positive correlation / as mesh size increases, fish length increases / ora ; weak correlation (due to high spread of data) ;		[2]
(ii)	small fish escape through mesh; more larger fish retained (causes an) increase in mean ;	look for idea of greater proportion of larger fish “skewing” the mean	[2]
(d)	THREE of: allows fish to reach sexual maturity/eq ; increase recruitment / reproduce / eq ; increase fish stocks / population / stops overfishing / eq ; small fish are thrown back dead / dumping of fishing ; more fishing to compensate for the loss / fishing for other species increases / illegal fishing ; effects on economy / unemployment / eq ;		[3]
			[Total: 12]

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Question	Expected answers	Additional guidance	Mark
2 (a)	<p>overall increase in oxygen production as light intensity increases ;</p> <p>negative oxygen up to 100 light / converse ;</p> <p>oxygen production levels off / decreases at 420 – 450 au of light ;</p>		[2]
(b)	<p>from 0 to 100 a.u., increase in salinity to 3.8% tends to reduce oxygen ;</p> <p>from 100 a.u., increase in salinity to 3.8% increases oxygen production ;</p> <p>4.0% and 3.6% salinity show similar oxygen levels / eq ;</p>		[2]
(c)	<p>3.8% (salinity) is optimal / ideal salinity / eq ;</p> <p>respiration uses oxygen / photosynthesis releases oxygen / eq ;</p> <p>respiration is faster than photosynthesis below 100 a.u. ;</p> <p>photosynthesis faster than respiration above 100 a.u. ;</p> <p>idea of compensation point at 100 a.u. / respiration rate and photosynthesis rate are equal ;</p> <p>non optimal Salinity affects respiration <u>and</u> photosynthesis ;</p> <p>reference to enzymes ;</p>		[4]
			[Total: 8]

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Question	Expected answers	Additional guidance	Mark
3 (a)	<p>SEVEN of:</p> <p>ref. to SA:Vol ratio ;</p> <p>large organisms have lower SA:Vol ratio / small organisms have larger SA:Vol ratio ;</p> <p>example of small organisms with high SA:Vol ratio / example of large organisms with low SA:Vol ratio ;</p> <p>ref. to oxygen movement in <u>and</u> carbon dioxide movement out ;</p> <p>ref. to diffusion (of O<sub>2</sub>/CO<sub>2</sub>) ;</p> <p>large organisms have higher oxygen demand;</p> <p>for respiration of <u>cells/tissues</u> ;</p> <p>need gas exchange organs / gills / lungs / eq ;</p> <p>protrusions / eq (to increase SA) ;</p> <p>multicellular organisms have a long diffusion path / eq / converse ;</p> <p>transport system / blood ;</p> <p>ventilation movement to maintain gradient ;</p>	<p>only accept correct example of an organ</p>	[7]

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<b>(b)</b>	<p>EIGHT of:</p> <p>large (gill) surface area ;</p> <p>(achieved by) primary gill lamellae ;</p> <p>(and) secondary gill lamellae ;</p> <p>ref. to pumped ventilation ;</p> <p>buccal cavity volume increases / pressure reduces (during intake of water) ;</p> <p>due to muscle contraction (ONCE) ;</p> <p>buccal cavity volume decreases and pressure increases (forcing water over gills / into opercular cavity /eq) ;</p> <p>by raising floor plate / eq ;</p> <p>operculum prevents back flow / acts as a valve / eq ;</p> <p>ref. to maintaining diffusion gradient ;</p> <p>of O<sub>2</sub> <u>and</u> CO<sub>2</sub> ;</p> <p>(due to) rich blood supply / capillary network ;</p> <p>heart pumping blood ;</p> <p>ref. to counter current ;</p>	<p>accept a labelled diagram of gill structure</p>	<b>[8]</b>
<b>[Total: 15]</b>			

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Question	Answer	Additional Guidance	Mark
4 (a)	<p>Max. FIVE of:</p> <p><b>For:-</b></p> <p>commercially viable fish / high market value / eq ;</p> <p>(sturgeon is a) major foodstock / loss would affect food chains / eq ;</p> <p>(loss of sturgeon causes) a reduction in biodiversity / eq ;</p> <p>prevent loss of fishing fleet &amp; jobs / eq ;</p> <p><b>Against:-</b></p> <p>may disrupt food chains in other lake ;</p> <p>may eat other organisms ;</p> <p>may have no predator ;</p> <p>outcompete indigenous species ;</p> <p>loss of commercially viable fish in other lake ;</p> <p>bringing in disease ;</p> <p><b>Factors to consider:-</b></p> <p>Max. THREE of:</p> <p>predators ;</p> <p>food source / niche changes ;</p> <p>breeding ability ;</p> <p>abiotic factors e.g. temperature ;</p> <p>potential of habitat damage at other lake ;</p> <p>logistics of moving the fish ;</p> <p>sufficient numbers to prevent inbreeding ;</p>		[7]

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<b>(b)</b>	<p>EIGHT of:</p> <p>oil (tanker) spill ;</p> <p>oily water from ballast ;</p> <p>oil blocking light penetration ;</p> <p>(causing) reduced photosynthesis ;</p> <p>effect of oil on feathers / fur ;</p> <p>toxicity (to animals) / eq ;</p> <p>effect on food chains ;</p> <p>drilling causing damage to sea bed / eq ;</p> <p>silt / sediment (from drilling) ;</p> <p>burning oil ;</p> <p>release of CO<sub>2</sub> ;</p> <p>(causing) enhanced greenhouse effect / eq ;</p> <p>one stated consequence of greenhouse effect;</p>		<b>[8]</b>
			<b>[Total: 15]</b>

e.g. ice cap melting / sea level rise / climate change / acidification / eq