Cambridge International AS & A Level

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MARINE SCIENCE **9693/03**

Paper 3 A2 Structured Questions **October/November 2016**

MARK SCHEME

Maximum Mark: 75

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 October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

This mark scheme will use the following abbreviations:

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

Question	Answer	Marks	Guidance
1(a)(i)	*any 3 of:* water is shallow; allows enough light to reach the plants (for photosynthesis); better nutrient supply from runoff from land / mixing of water by strong water movement; require substrate for attachment;	**3**	
1(a)(ii)	*any 4 of:* ref. to region where both seagrass and kelps occur; ref. to regions where neither is found; ref. to region where only kelp is found; ref. to region where only seagrass is found; ref. to region where both seagrass and kelp but more kelp than sea grass; ref. to region where both seagrass and kelp but more seagrass than kelp;	**4**	
1(a)(iii)	*any 2 of:* high productivity means there is a lot of food available / provides food for a variety of marine species / supports diverse food web; provides shelter from predators / nursery grounds for a variety of fish / marine mammals; slowed water movement prevents animals being swept away / provides a habitat for sessile organisms; (photosynthesis) releases a lot of oxygen / takes CO_2 out of water / idea of carbon sink;	**2**	

Question	Answer	Marks	Guidance
1(b)	*any 4 of:* sea otters are predators of sea urchins that feed mainly on kelps; removal of sea otters allowed numbers of sea urchins to increase; (more sea urchins) over graze / each too much kelp; loss of kelp reduces food supply to rest of food web so numbers decline; loss of kelp so faster water movement / fewer suitable attachment points for sessile invertebrates; increase in planktonic invertebrates as fewer sessile invertebrates on kelp; overfishing removes fish and shellfish (crabs, abalones, etc.); fewer sharks as less otters to feed on; **AVP**;	**4**	e.g. relevant effects of overfishing

Question	Answer	Mark	
2(a)(i)	(6^2 / 10 =) 3.6;	**1**	
2(a)(ii)	(time = distance^2 ÷ diffusion coefficient) time = 3000^2 ÷ 3.6; time = 25 000 00 ms / 2500 s / 41.7 minutes;	**2**	**ECF** for incorrect answer to **a(i)** correct answer, no working = 2 marks
2(a)(iii)	*any 3 of:* newly hatched fish start to move / are active / get larger, so oxygen demand increases; (growing so) body becomes larger / has more volume; surface area:volume decreases; ref. to longer time taken for oxygen to reach cells in the middle; diffusion distance is too great (so will take too long for O_2 to reach cells in the middle);	**3**	

Question	Answer	Marks	Guidance
2(b)(i)	*any 4 of:* mouth open **and** operculum closed; pressure in mouth / opercular cavity lowered; water pulled into mouth and back over gills; mouth closes and operculum opens; pressure in mouth / opercular cavity increased; water forced out of operculum;	**4**	
2(b)(ii)	*any 1 of:* idea that, ram ventilation increases the rate / speed of movement of water across the gills; maintains diffusion gradient;	**1**	

Question	Answer	Marks	
3(a)(i)	**A** – spawning / release of gametes; **B** – fertilisation; **C** – growth / maturation;	**3**	
3(a)(ii)	*any 1 of:* eggs may not be fertilised by sperm / increases chance of fertilisation; eggs are eaten by predators; idea that many eggs die due to adverse conditions;	**1**	e.g. change in temperature / pH
3(a)(iii)	anchors / attaches larva to solid substrate / to move to a good settling place;	**1**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(b)</td><td>
<table>
<tr><td rowspan="2">stage in life cycle</td><td colspan="3">habitat</td></tr>
<tr><td>oyster</td><td>shrimp</td><td>giant clam</td></tr>
<tr><td>larvae</td><td>ocean surface;</td><td>ocean surface then moves to estuaries</td><td>ocean surface</td></tr>
<tr><td>adults</td><td>tidal areas / estuaries</td><td>benthic / sea floor / deep water;</td><td>reef flats / coral reef / shallow lagoon / rocky shore;</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td>3(c)(i)</td><td>idea of, (increase in) use of fossil fuels / road vehicles;</td><td>1</td><td></td></tr>
<tr><td>3(c)(ii)</td><td>carbon dioxide dissolves in sea water / dissolution;
forming carbonic acid / hydrogen ions (which lowers pH);</td><td>2</td><td></td></tr>
<tr><td>3(c)(iii)</td><td>any 2 of:
oysters cannot make their shells / shells are damaged;
ref. change in solubility / availability of calcium (carbonate);
so greater chance of disease / predation;
AVP;</td><td>2</td><td>e.g. enzymes denatures / not at optimum</td></tr>
</table>

Question	Answer	Marks	
4(a)	any *2×2* of: ref. to use of sonar; enables fish to be found more easily / locates entire shoals of fish (so more caught); ref. to, fish aggregation devices / FADs, / tracked by GPS / satellite; attract / locate large numbers / shoals of fish (so more caught); ref. to purse seine nets / very large / very long nets; encircle and catch large number of fish in a single net; ref. to benthic trawling; (drags along sea floor and) lifts up fish buried in sand missed by other types of trawling; ref. to factory ships; collect from fishing boats at sea / can store / freeze / process fish, so no longer need to return to port enabling longer times of fishing;	**4**	
4(b)(i)	*any 2 of:* idea of, overfishing; so too few fish reproducing; so recruitment too low to replenish stock; regulations / restrictions / quotas, limit catch;	**2**	
4(b)(ii)	((184 158 – 5000) – (83 100 – 5000) =) 101 058 tonnes;	**1**	
4(b)(iii)	*any 2 of:* idea of, CPUE decreasing; less income for more effort; fishing effort starts to decrease because people move away from fishing / effort might shift to other income streams;	**2**	

Question	Answer	Marks	Guidance
5(a)	the mantle provides a home / habitat for the dinoflagellates / the dinoflagellates are protected from adverse weather / the dinoflagellates have access to sunlight; **OR** clam provides mineral nutrients to dinoflagellates; the dinoflagellates photosynthesise **+** produce sugar / amino acids / fatty acids for the clam;	**2**	
5(b)(i)	to remove algae / parasites / other organisms (or example of) / silt / sand / debris;	**1**	
5(b)(ii)	clams produced in tanks / tanks are aerated / nutrients added / high stocking density;	**1**	
5(c)(i)	younger clams are all male so will not be able to breed / female sex organs have not developed;	**1**	
5(c)(ii)	Method 1 – internal organs could be damaged so the clam could die; Method 2 – a mature clam is sacrificed to obtain the sex cells; Method 3 – clam could dehydrate if left too long in the sun / clam may not respond to treatment;	**3**	**A** (clam) enzymes denature
5(d)	*any 2 × 2 of:* reef B – river brings chemicals / copper from mine; (which are) toxic / kill clams ; **OR** the river brings sediment from the mine; (which) reduces light so preventing photosynthesis in dinoflagellates ; reef C – closest to the town; so more pressure from fishing / poaching; **OR** more pollutants from waste;	**4**	**ORA** for reef A **ORA** for reef A **ORA** for reef A **A** more litter / sewage

Question	Answer	Marks	Guidance
6(a)	*any 1 of:* anti-fouling paints from ships; runoff from industrial disposal; isn't readily broken down (so builds up in sediment);	**1**	
6(b)(i)	methyl mercury builds up at each stage of the food chain / bioaccumulation; scorpion fish and monkfish are at a higher trophic level than red mullet;	**2**	
6(b)(ii)	filter-feeding worms; same trophic level as small crustaceans;	**2**	
6(b)(iii)	highest concentration of methyl mercury; so harmful / toxic / lethal to unborn baby;	**2**	
6(c)	*any 3 of:* silt particles block out light; preventing / reducing photosynthesis (in phytoplankton); less growth and reproduction of phytoplankton; less food / oxygen for zooplankton; population of zooplankton decreases;	**3**	**ORA** for any point **R** photosynthesis in zooplankton and max 2 if this error made
6(d)	*any 1 of:* treat / decontaminate waste before being dumped at sea; dump on land in special toxic waste disposal sites;	**1**	

Question	Answer	Marks	Guidance
7(a)(i)	*any 2 × 2 of:* 1. using sail boats to reach observation points / switching off engines at observation points / using a small engine boat; to reduce the pollutants / named pollutants from boats; **OR** limit engine noise that can interfere with migration; 2. providing sufficient disposal facilities for food waste / food packaging; to prevent endangering animals from swallowing plastic / prevent encouraging sea birds scavenging around the boats; 3. providing sufficient sanitary facilities; to prevent human urine / faeces entering water and encouraging eutrophication; 4. carrying only small numbers of people / limit number of boats at one time; to reduce noise that may interfere with migration ;	**4**	
7(a)(ii)	*any 2 of :* provides employment for local people on boats / accommodation; brings money into the local economy; supports development of education / businesses for local people; raises awareness of local people about conservation; improved infrastructure / roads / hospitals;	**2**	