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**MARINE SCIENCE**

**9693/03**

Paper 3 A2 Structured Questions

**May/June 2018**

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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**PUBLISHED****Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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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)

Question	Answer	Marks	Guidance																
1(a)	shallow waters ;	1																	
1(b)	<table border="1" data-bbox="479 284 1191 520"> <thead> <tr> <th>photosynthetic pigment</th> <th>green algae</th> <th>red algae</th> <th>brown algae</th> </tr> </thead> <tbody> <tr> <td>chlorophyll a</td> <td>present</td> <td>present</td> <td>present</td> </tr> <tr> <td>xanthophyll</td> <td>absent</td> <td>present</td> <td>present</td> </tr> <tr> <td>phycobilin</td> <td>absent</td> <td>present</td> <td>absent</td> </tr> </tbody> </table> <p style="text-align: center;">; ;</p>	photosynthetic pigment	green algae	red algae	brown algae	chlorophyll a	present	present	present	xanthophyll	absent	present	present	phycobilin	absent	present	absent	2	mark in columns
photosynthetic pigment	green algae	red algae	brown algae																
chlorophyll a	present	present	present																
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phycobilin	absent	present	absent																
1(c)	<p><i>any 4 of:</i> <i>idea that:</i> different wavelengths of light penetrate different depth in the water ;</p> <p>red <b>or</b> long wavelength, travels shortest distance / only penetrates shallow water ; <b>OR</b> blue / violet / green <b>or</b> shorter wavelengths, travel further / penetrate deeper water ;</p> <p>so green algae in shallow water because <u>they use</u> red light / 700 nm ;</p> <p>red algae medium depth water because <u>they use</u> green light / yellow light / 500–600 nm ;</p> <p>brown algae in deep water because <u>they use</u> blue / violet light / 400–450 nm ;</p>	4	<p><b>A</b> names of seaweeds from Fig.1.1 <b>A</b> colours for wavelength</p> <p><b>A</b> absorb / trap for use</p> <p><b>A</b> blue-green / bluey green</p>																

Question	Answer	Marks	Guidance
1(d)	<p><i>any 2 of:</i></p> <p>avoids <u>competition</u> for light / same wavelengths ;</p> <p>avoids <u>competition</u> for places to attach (to substrate) ;</p> <p>avoids <u>competition</u> for minerals / carbon dioxide / nutrients ;</p> <p>avoids damage in adverse weather conditions / extreme temperatures / wave action ;</p>	2	<p>I competition unqualified</p> <p>I niche</p> <p>I space unqualified A space for growth</p> <p>I resources unqualified</p>

Question	Answer	Marks	Guidance
2(a)	<i>idea of:</i> mud holding water when tide is out / water does not evaporate easily / very little evaporation occurs ;	1	<p>I ref. to water <u>movement with tide</u></p> <p>A <u>mud absorbs water</u></p>
2(b)(i)	<i>idea of:</i> standardising / controlling variable <b>OR</b> description of ;	1	I to make result more comparable
2(b)(ii)	provides <u>oxygen</u> for crab <u>respiration</u> / for <u>aerobic respiration</u>	1	R anaerobic respiration
2(b)(iii)	as salinity / <u>concentration</u> of the saline decreases the concentration of the crabs decreases ;	1	<p>A idea of, conc. inside crab matches conc. of saline solution</p> <p>R if any idea of regulation</p>
2(c)(i)	<p>(body fluids / blood) are less concentrated / hypotonic / have a higher water potential than sea water <b>ORA</b> ;</p> <p>lose water by osmosis ;</p>	2	A water diffuses out

Question	Answer	Marks	Guidance
2(c)(ii)	<p><i>any 4 of:</i> ref. to drinking (sea water) ;</p> <p><i>idea of: <u>excess</u> salt (in blood) excreted ;</i></p> <p>through gills / kidney / urine ;</p> <p>ref. to chloride (excretory) cells;</p> <p>ref. to use of energy / active transport ;</p>	4	<p><b>A</b> idea of absorbing (sea) water</p> <p><b>A</b> ions / correct named ions (<math>\text{Na}^+</math>, <math>\text{Cl}^-</math>)</p> <p><b>A idea of:</b> 'pumped out' for active transport</p>

Question	Answer	Marks	Guidance
3(a)(i)	<p>lobsters live in burrows / crevices (so would not be caught in net) ;</p> <p><u>net would be damaged</u> (trawling over a rocky shore) ;</p>	2	<p><b>I</b> damage to rocky shore / habitat – mark is for NET damage</p>
3(a)(ii)	<p><b>2 of:</b> lobster breeding ;</p> <p>catching, prevents / reduces, breeding success / reduces recruitment ;</p> <p>ref. to lobster moulting ;</p> <p>soft body damaged if caught ;</p>	2	<p>Any explanation (MP2 and 4), must be linked to an appropriate reason (MP1 and 3)</p> <p><b>I</b> ref. to overfishing unqualified</p>
3(b)	<p>warmer currents drive lobster to colder waters further north ;</p> <p>less cod to eat the lobsters ;</p>	2	<p><b>I</b> any advantages of warmer waters</p>
3(c)	<p><b>stones</b> – keep trap on sea bed where lobster is found / prevents trap from being washed away ;</p> <p><b>small exit</b> – reduces by-catch / catching undersized / juvenile lobsters ;</p>	2	<p><b>A</b> any ref to something escaping</p>

Question	Answer	Marks	Guidance
3(d)	lobsters only found over the rocky shore / areas, <b>or</b> no lobsters over sand ;	1	
3(e)(i)	time for marine animals and plants to find the artificial reef or colonise it <b>or</b> time for, food chains / ecosystems, to develop <b>or</b> idea of succession ;	1	<b>A</b> if only in context of coral
3(e)(ii)	place the artificial reef over sandy areas ;  to increase the available habitat for lobster ;	2	<b>A</b> more nursery ground for lobster

Question	Answer	Marks	Guidance																	
4(a)	<p style="text-align: center;"><b>Table 4.1</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">stage in life cycle</th> <th colspan="2">habitat</th> </tr> <tr> <th>tuna</th> <th>grouper</th> </tr> </thead> <tbody> <tr> <td>egg</td> <td>free floating in plankton</td> <td>free floating in plankton ;</td> </tr> <tr> <td>larva</td> <td>free floating in plankton</td> <td>seagrass beds and mangroves ;</td> </tr> <tr> <td>juvenile</td> <td>open ocean</td> <td>seagrass beds then migrate offshore ;</td> </tr> <tr> <td>adult</td> <td>open ocean</td> <td>coral reefs ;</td> </tr> </tbody> </table>	stage in life cycle	habitat		tuna	grouper	egg	free floating in plankton	free floating in plankton ;	larva	free floating in plankton	seagrass beds and mangroves ;	juvenile	open ocean	seagrass beds then migrate offshore ;	adult	open ocean	coral reefs ;	4	<p><b>A</b> free-floating / drifting / surface waters / planktonic</p> <p><b>A</b> pelagic for open ocean ;</p> <p><b>A</b> reefs</p>
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4(b)(i)	partly extensive because water flows through the cages supplying oxygen / removing waste <b>or</b> pH / temperature not controlled ;  partly intensive because the fish are fed / kept in cages ;	2	<b>I</b> ref. to controlled environment unqualified																	

Question	Answer	Marks	Guidance
4(b)(ii)	(too many) juveniles are caught before they have a chance to reproduce ;  so numbers of tuna will decrease over time <b>or</b> idea of, no / reduced recruitment ;	<b>2</b>	I ref. to sustainability
4(b)(iii)	<i>any 2 of:</i> <i>idea of:</i> overfishing of mackerel, sardines and squid / food fish ;  pelleted food makes use of waste from human food ;  all / most of food pellet will be eaten or digested, <u>so less</u> pollution under cage / <b>ORA</b> ;  pelleted / dry food easier to store ;	<b>2</b>	I ref. to pelleted food being cheaper I sustainable unqualified  <b>A idea of:</b> <u>less waste</u> food / faeces from pellets being eaten
4(b)(iv)	easily disturbed by light / temp changes / noise ; collisions in cages can kill (juveniles / adults) ;	<b>2</b>	I any ref. to life stage  <b>R</b> eggs / larvae killed by cage collision I ref. to tuna being carnivores
4(c)	<i>any 2 of: idea of:</i> more / enough, supply to meet demand <b>or</b> constant supply to sell ;  <i>idea of:</i> costs would reduce qualified ;  <i>idea of:</i> less pressure on wild tuna populations <b>AW</b> ;  reduces by-catch ;  captive bred tuna produced to order ;  less likely to have (bioaccumulation of) mercury / toxins ;	<b>2</b>	<b>A</b> idea of consistent contribution to economy

Question	Answer	Marks	Guidance
5(a)	<p><i>any 2 of:</i> decreasing (trend over 6 years) ;</p> <p>almost linear decrease ;</p> <p><u>decreases</u>, by / about, 2000 billion tonnes ;</p> <p>small increase (in winter) and larger decrease (in summer) most years ;</p>	2	<p><b>A</b> <math>2000 / 6 = 333(.33)</math> billion tonnes per year <b>R</b> 2000 billion tonnes per year</p> <p>ref. to fluctuations must be qualified</p>
5(b)(i)	<p><i>any 2 of:</i> <u>water</u> further south too warm <b>ORA</b>;</p> <p><i>idea of:</i> prey species move north ;</p> <p>more competition from other species moving in (from the south) ;</p> <p>less oxygen for respiration / higher demand for oxygen for respiration ;</p>	2	<p><b>A</b> prey species more abundant</p> <p><b>A</b> in context of new predators</p> <p><b>I</b> ref. to enzyme efficiency / denaturing</p>
5(b)(ii)	<p><i>any 1 of:</i> less, fish / shrimp / catch, to sell / less (income from) fishing (as they cannot get to fishing areas) ;</p> <p>less (income from) tourism (as cruise ships cannot land) ;</p>	1	<p><b>A</b> there is less fishing / they can't catch as many fish</p> <p><b>A</b> affects tourism as passengers cannot get to shore</p>
5(b)(iii)	<p><i>any 1 of:</i> can fish for new species (mackerel and tuna) / can fish high value species like tuna (so increased income) ;</p> <p>greater area of land / (more) nutrient rich land, for agriculture <b>AW</b> ;</p> <p>plants will grow (on nutrient rich soil) and become a tourist attraction ;</p> <p>can sell nutrient rich crushed rock (so increasing income ) ;</p>	1	<p>ideas need to lead to <u>increased income</u>.</p> <p><b>A</b> more fish species present to sell</p>

Question	Answer	Marks	Guidance
5(c)	<p><i>any 3 of:</i>  darker surface absorbs more heat / light (from solar radiation) ;  more dark surface available ;  more heat / infrared is radiated back to atmosphere (from the surface) ;  increasing global warming / temperatures ;  albedo effect ;</p>	3	<p><b>A</b> dark surfaces reflect less heat / light ;  <b>A</b> trapped for absorbed</p> <p><b>R</b> more heat <u>reflected</u> back to atmosphere</p>

Question	Answer	Marks	Guidance
6(a)	<p><i>any 2 of:</i>  number of nests fluctuate / increase and decrease repeatedly ;  no clear trend / no correlation ;  (roughly) stable 1995–2000 ;  decrease after 2000 / from 2000 to 2004 ;</p>	2	<p><b>A</b> number of nests increase then decrease, then increase and decrease again <b>OR</b>  number of nests increases and decreases</p>
6(b)(i)	<p><i>any 2 of:</i>  (more tourism / people on beaches) disturb / damage nest sites ;  lights confuse young turtles (so do not reach the sea) ;  people collect eggs / turtles (to eat) ;  coastal developments (piers, hotels etc.), prevent females reaching the shore / damage nesting sites;  entrapment / damaged, by beach litter ;</p>	2	

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Question	Answer	Marks	Guidance
6(b)(ii)	<p><i>any 2 of:</i>  hunted for food ;</p> <p>any ref. to being caught by a fishing technique / as by-catch ;</p> <p>eat plastics disposed by humans, that block the intestines / cause choking ;</p> <p>damaged by being hit by boats / ships <b>or</b> propellers of boats / ships ;</p> <p>killed by pollution from, oil / fuel / chemicals ;</p> <p>overfishing of turtle prey ;</p> <p>AVP;</p>	<b>2</b>	<p><b>A</b> drowning</p> <p><b>A</b> suffocation for choking  <b>A</b> idea of trapped by litter and damage caused to turtle</p> <p><b>I</b> TBT or any agricultural chemical from land</p> <p>e.g. exotic species, parasite, disease</p>
6(c)(i)	<p><i>marking and covering nests with netting:</i>  <i>idea of:</i> stops predators reaching eggs / lets people know they are there (to limit damage to nests) ;</p> <p><i>24h watch during hatching</i>  <i>idea of:</i> keep predators away (from young turtles) / help (turtles) to reach sea / <b>AW</b> ;</p>	<b>2</b>	

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
6(c)(ii)	<p><i>any 2 of:</i></p> <p>numbers of nests in the whole state / Florida is increasing ;</p> <p>number of nests on indicator beaches is increasing ;</p> <p>manipulated data quote for either beach or whole state ;</p> <p>support is weak because, only five years of survey / not long enough to see any long term trend ;</p> <p>the number of nests does not increase consistently / large fluctuations ;</p> <p>indicator beaches may not be representative / show a different pattern to the whole state ;</p>	<b>2</b>	<p><b>A</b> overall increase if no beach specified = 1 mark</p> <p>e.g. increase by 850 / 41% on indicator beach or 19 000 / 49% whole state</p> <p><b>A</b> about 20 000 / about 50%</p> <p><b>A</b> no conservation data for indicator beaches before survey</p>

Question	Answer	Marks	Guidance
7(a)(i)	<p><i>gene</i>: a length of DNA (deoxyribonucleic acid) that codes for a specific protein (product) / polypeptide ;</p> <p><i>phenotype</i>: the interaction of the genotype of an organism with the environment / <b>AW</b> ;</p> <p><i>selective breeding</i>: crossing individuals that show, the desired phenotype / advantageous features, with one another ;</p>	3	<p><b>A</b> any valid definition <b>R</b> proteins <b>I</b> gene stores genetic info.</p> <p><b>A</b> physical result of genotype <b>A</b> expression of the genes as, visible / physiological, features of an organism</p>
7(a)(ii)	<p><i>increase growth rate</i>: reach <u>saleable size</u> more quickly / more fish to market sooner / faster;</p> <p><i>disease resistance</i>: more fish survive / less damage by disease / better quality / less money spent on drugs or treatment ;</p> <p><i>early age of sexual maturity</i>: fish start <u>breeding earlier</u> / sooner, so increase numbers faster / sold sooner ;</p>	3	<p><b>I</b> ref. to food</p>
7(b)(i)	<p><i>any 3 of</i>;</p> <p>no change in percentage survival in either group up to day 5 ;</p> <p>at 10 days both groups have (1%) less survivors / (1%) of fish die / they are the same ;</p> <p>groups <b>A</b> and <b>B</b> both decrease, but group <b>B</b> decreases more / continues to decrease ;</p> <p>group <b>A</b> decreased 1% every 5 days from day 15 to day 30 ;</p> <p>relevant data <u>manipulation</u> ;</p>	3	<p>e.g. 12 % more survive in group <b>A</b> / 4% die in group <b>A</b> but 16% in group <b>B</b></p>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
7(b)(ii)	in group <b>A</b> disease cannot spread / cannot be passed on easily (so more survive) <b>ORA</b> ;	<b>1</b>	<b>A</b> group <b>A</b> can't get disease / less likely to get disease / are immune / are resistant to IPN (so more survive)
7(b)(iii)	group <b>C</b> were not exposed to IPN / a small percentage died of reasons other than IPN / group <b>C</b> were naturally resistant (to IPN) ;	<b>1</b>	<b>I</b> ref. to control unqualified <b>A</b> naturally immune