
MARINE SCIENCE

9693/03

Paper 3 Structured Questions

October/November 2019

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 International will not enter into discussions about these mark schemes.

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This document consists of **15** printed pages.

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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Question	Answer	Marks	Guidance
1(a)(i)	<i>any 2 of:</i> diatoms / dinoflagellates / cyanobacteria ;	1	
1(a)(ii)	open ocean ;	1	A surface water / photic zone / photic layer I pelagic
1(b)	<i>any 3 of:</i> carbon in carbon dioxide ; combines with (hydrogen from) water ; to form glucose / carbohydrate / sugar ; ref. to using, light <u>energy</u> / enzymes ; ref. to chlorophyll trapping light (energy) ;	3	A 2 marks for a correct equation A light only if qualified e.g. used for photolysis
1(c)	<i>any 3 of:</i> ref. to light and temperature as <u>limiting</u> factors ; little photosynthesis / productivity between mid-September and mid-May ORA ; as the temperature is too cold, so enzymes less active ORA ; there is not enough light (intensity and duration) for <u>photosynthesis</u> / phytoplankton killed ORA ;	3	I CO ₂ and mineral salts as limiting factors A In winter
1(d)(i)	<i>any 2 of:</i> a <u>layer</u> of water (separates surface and deep water) ; (in which) temperature decreases steeply with depth ; warm water on the surface / cold water below thermocline ;	2	I area

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Question	Answer	Marks	Guidance
1(d)(ii)	<i>any 3 of:</i> constant upwelling (of nutrients) ; more nutrients brought to photic zone / surface ; ref. to an example of a nutrient and its use in phytoplankton ; so more photosynthesis / productivity ;	3	e.g. more magnesium for chlorophyll formation

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Question	Answer	Marks	Guidance
2(a)(i)	gas A oxygen and gas B carbon dioxide ;	1	A correct formula
2(a)(ii)	diffusion ;	1	
2(b)(i)	<i>any 1 of:</i> for protection from predators ; so that they are not washed away by the current ;	1	
2(b)(ii)	<i>point A: idea of:</i> strong / swirling current might dislodge eggs / expose eggs to predators ; <i>point C:</i> reduced water flow so less, oxygen / gas exchange ;	2	
2(c)	<i>any 4 of:</i> larger egg has smaller surface area to volume ratio ; so diffusion is less efficient ; (greater water flow rate needed) to maintain a concentration / diffusion gradient ; to provide more oxygen ; to remove more CO ₂ ; oxygen required for respiration ;	4	A longer diffusion distance / slower diffusion
2(d)(i)	16.5 °C ;	1	

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Question	Answer	Marks	Guidance
2(d)(ii)	<p><i>any 3 of:</i> large eggs have a larger food store / yolk ; so grow bigger before hatching ; yolk sac provides food supply after hatching (so do not need to find so much food) ; less food in cold water ; can outcompete fry of other salmon species ; higher / 80% survival, below 16 °C / in colder water ; oxygen levels decrease with increasing temp / not enough oxygen at, temperatures above 16 °C / warmer water ORA ; at lower temperatures, rate of diffusion is lower, but oxygen levels are higher ; at lower temperatures, rate of respiration is less / less demand for oxygen ;</p>	3	A suitable ref. to enzymes

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Question	Answer	Marks	Guidance
3(a)	<i>habitat:</i> (freezing water in) Bearing Sea ; <i>any 2 of:</i> <i>idea of:</i> consumer / predator ; <i>idea of:</i> 2nd and 3rd trophic level ; <i>idea of:</i> food source for fish at higher trophic levels ;	3	A seas around Alaska A ref. to named examples I definitions of habitat and ecological niche
3(b)(i)	decrease in the number of crabs per pot and an increase in total catch ;	1	
3(b)(ii)	<i>any 2 of:</i> more crabs caught (by more boats / more pots) ; more competition for the crabs / less catch per unit effort ; population (density) of crabs decreasing ;	2	I overfishing A number of crabs decreasing

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Question	Answer	Marks	Guidance
3(b)(iii)	<p><i>any 2 · 2 of:</i> overfishing ; too few breeding adults to replace those caught / takes a long time for them to reach maturity and recover ;</p> <p>loss of / overfishing of, food source for crabs AW ; (too much) competition for food so younger crabs die ;</p> <p>more crab predators move into area ; many young crabs eaten ;</p> <p>more demand for crabs/increased quota ; fishing effort increases ;</p> <p>global warming / sea temperatures are increasing ; crabs / crab food sources, move to colder water ;</p> <p>crabs become diseased ; many crabs die ;</p>	4	<p><i>factor causing a decrease in blue crab population (1 mark) and a reason for the decrease (1 mark)</i></p>

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Question	Answer	Marks	Guidance
4(a)	<p><i>any 3 of:</i> villagers now need to buy all their food and fresh water ; as the land is too salty/infertile ; more disease outbreaks ; <i>idea of:</i> less income because large companies keep profits ;</p>	3	A cannot grow (enough of) their own food
4(b)	<p><i>any 3 of:</i> monsoon brings heavy rains ; so surplus / supply of fresh water ; which washes the salt from the silt / ponds ; ditches and gates allow the (salt) water to drain into the sea ;</p>	3	<p>A more rainfall</p> <p>A earth banks keep out salt water</p>
4(c)	<p><i>any 4 of:</i> greater yield of prawns and fish ; <i>idea of:</i> large difference in prawns at higher depth only ; fish have a large difference at high and low depth ; so more to sell / more profit ; less money spent on food / fresh water ; reduced chance of disease ; <i>idea of:</i> allows farmer to become self-sufficient again ; ref. to manipulation of figures ;</p>	4	

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Question	Answer	Marks	Guidance
5(a)	<p><i>any 2 of:</i> (marine organisms on the boat) increase mass of boat / make boat heavier ; <i>idea that:</i> boat is less streamlined / more friction / increased drag ; uses more fuel / increases cost to move the boats ;</p>	2	A movement slowed / more resistance
5(b)(i)	<p><i>any 2 of:</i> reduces the number of females able to produce eggs ; (fewer eggs to be fertilised) reduces the number of larvae / offspring ; (over time) not enough larvae produced to replace the adults ;</p>	2	A low recruitment in future years / less population of adults in future
5(b)(ii)	<p><i>any 3 of:</i> TBT in the water absorbed by algae / phytoplankton ; TBT bound in sediments taken in by filter feeders ; small fish / zooplankton eat large amounts of plants containing TBT ; TBT not excreted / not broken down, so remains in the body ; (large number of) small fish containing high concentration of TBT eaten by tuna / dolphin ; TBT increases in / at highest concentration inside tuna / dolphin ;</p>	3	I biomagnification A primary producers / seagrass

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Question	Answer	Marks	Guidance
5(b)(iii)	<p><i>any 2 of:</i></p> <p><i>idea that:</i> not long / only a few years, since the total ban on use ;</p> <p><i>idea that:</i> sediments will contain TBT for many years ;</p> <p><i>idea that:</i> living organisms will contain TBT for many years ;</p> <p><i>idea that:</i> some countries do not regulate as strictly as they should ;</p> <p><i>idea that:</i> TBT released by dredging / <u>benthic</u> trawling ;</p>	2	<p>I TBT takes a long time to decompose</p> <p>A some countries still using TBT despite ban / ignore ban</p> <p>A TBT released by rough wave action in shallow water / in harbours</p>

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Question	Answer	Marks	Guidance
6(a)	tourism based on the appreciation of the natural environment / responsible travel to areas that conserves the environment (and improves the well-being of local people) AW ;	1	
6(b)	<p><i>feature</i> – natural river pool ;</p> <p><i>explanation</i> – does not ruin habitat for construction / does not involve using chemicals / chlorine / does not involve using large volumes of fresh water / does not involve using electricity for pumps ;</p> <p><i>feature</i> – non-motorised water sports ;</p> <p><i>explanation</i> – no oil leaks to pollute reef / no fuel to produce carbon dioxide / no propeller damage to reef / coral / less noise to disturb wildlife ;</p>	4	I natural cleaning by river flow
6(c)	<p><i>feature</i> – air-conditioned room (uses electricity / energy) ;</p> <p><i>improvement</i> – use natural ventilation or solar powered fan OR wind turbine to generate electricity ;</p> <p><i>feature</i> – teak floors and hardwood furnishings from Asia ;</p> <p><i>improvement</i> – use local / sustainable materials e.g. bamboo / wood from a plantation ;</p>	4	

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Question	Answer	Marks	Guidance
7(a)(i)	<p><i>any 2 of:</i></p> <p><i>selective breeding:</i> crossing individuals that show the desired phenotype / advantageous features with one another ;</p> <p>repeat over several generations ;</p> <p>humans select which organisms to breed ;</p>	2	
7(a)(ii)	<p><i>any 2 of:</i></p> <p><i>idea that:</i> in selective breeding dealing with whole genotypes or genomes ;</p> <p><i>idea that:</i> in genetic engineering 1 or more than 1 gene is transferred from one species to another ;</p> <p><i>idea that:</i> genetic engineering is more precise ORA ;</p> <p><i>idea that:</i> selective breeding takes several years ORA ;</p>	2	e.g. only changing 1 feature / adding or improving 1 feature
7(b)(i)	a control or description of ;	1	
7(b)(ii)	<p><i>idea that:</i> only smaller adults can breed ;</p> <p>small adults produce small offspring / pass on only genes for small size ;</p>	2	removing the large fish removed the, alleles / genes, for large size over 4 generations most of the alleles / genes were for small size
7(b)(iii)	increase in size ;	1	
7(c)(i)	promoter gene makes the transferred gene function ;	1	A turns desired gene on / allows year round growth

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Question	Answer	Marks	Guidance
7(c)(ii)	<p><i>advantage: 1 of:</i> <i>idea of:</i> novelty fish (so will sell more fish) ;</p> <p><i>idea of:</i> can sell for a higher price ;</p> <p><i>disadvantage: 1 of:</i> objection by some people of GM could cause fall in sales ;</p> <p>are licenced, so likely to be expensive / could be restrictions on breeding or sales ;</p> <p>some countries will not allow imports of GM, so reduced sales ;</p>	2	any ref. to fish escape / disease