Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

MARINE SCIENCE **9693/04**

Paper 4 A2 Data Handling and Free-Response **May/June 2019**

MARK SCHEME

Maximum Mark: 50

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.

Cambridge International is publishing the mark schemes for the May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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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.

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)	fish breed within the reserve / numbers increase in the reserve ; *idea of:* fish 'spill over' into areas surrounding reserve ;	**2**	
1(b)(i)	*any 2 of*: egg density decreases (with increasing distance) / negative correlation ; increase after 6 (km) / furthest from reserve ; *idea of:* wide variation (about the line of best fit) / weak correlation / (many) outliers ;	**2**	**A ORA** if explicitly stated **A** higher / goes at 7.6 (km) or 7.95/8 (km) **A** (many) anomalies **A** scattered / wide spread
1(b)(ii)	(–)0.4375 to (–)0.4875 (or correct rounding of) ; ; ;	**3**	**I** minus
1(c)	*any 4 of:* *(supporting benefits)* **(a)** egg density is higher within the reserve / more eggs in, reserve **OR** egg laying / breeding, is high in the reserve / high fecundity / high recruitment in reserve ; **(b)** fishing (effort), is high around the reserve showing fish, numbers are high / move out of reserve ; *(against benefits)* **(c)** there is only one set of data / no repeats / only one species ; **(d)** no mention of any controls / not compared to area without reserve ; **(e)** could be another (named), factor / variable, affecting (fish stocks / egg density / fishing patterns) ; **(f)** egg numbers, recover / increase, far away from the reserve (where fishing is less) ;	**4**	**A** egg density decreases with distance **A** spawning / breeding, is high in the, reserve / centre **R** *idea of:* having / needing to fish harder
1(c)	**(g)** there is, over / excess, fishing near to the reserve ; **(h)** the correlation is weak with / many outliers ; *idea of:* fishing effort is not a reliable / accurate / precise, measure **OR** CPUE would be a better measure / catch would be a better measure ;		

Question	Answer	Marks	Guidance
2(a)(i)	prevent, entry / loss, of <u>oxygen</u> ;	**1**	**I** other gases
2(a)(ii)	(microorganisms) respire / respiration ; using (organic) waste (in water) ;	**2**	**R** anaerobic respiration **A** using glucose / sugar / amino acids **I** food unqualified
2(b)(i)	1150 ; ;	**2**	
2(b)(ii)	*any 4 of:* **(a)** BOD is highest when fertiliser use is high <u>and</u> rain is high / **ORA** ; **(b)** fertiliser, dissolves in rain / runs off / leaches ; **(c)** increases growth of, algae / plants (in the water) **OR** eutrophication **OR** algal blooms ; **(d)** less photosynthesis (under algae / floating plants) ; **(e)** increased amounts of, dead material / decay / decomposition ; **(f)** (high) bacterial / decomposer / microorganism, respiration (rate) ;	**4**	**A** (primary) producer for plant **A** increased primary productivity

Question	Answer	Marks	Guidance
3(a)	*osmoconformer*: organisms that have salinity that is same as surrounding water / **AW** ; *euryhaline*: organisms that can tolerate a wide range of salinities / live in fresh and salt water / **AW** ;	**2**	**A** in terms of salt concentration or water potential
3(b)	*any 7 of:* *how* **(a)** drinking ; **(b)** remove / excrete , salt / sodium / suitable named ion ; **(c)** by, gills **OR** kidney ; **(d)** active transport / uses energy or ATP / requires respiration ; **(e)** absorption of water by kidney ; **(f)** low amount of urine / hypertonic urine / concentrated urine ; *why* **(g)** salt water has a higher salinity than body fluids / **AW** ; **(h)** water will leave body / dehydration ; **(i)** due to osmosis ; **(j)** damaging, cells / tissues / **AW OR** not enough fluid to transport / **AW** ;	**7**	**I** freshwater **I** diffuse or any idea of passive process **A** active pumping / actively pumps sensible impact of the dehydration

Question	Answer	Marks	Guidance
3(c)	*any 6 of:* **(a)** loss of biodiversity / disruption to, food chains / webs ; **(b)** *idea of:* benthic / sessile species affected in particular ; **(c)** releasing (large amounts of) brine / high salt concentration water ; **(d)** organisms lose water (by osmosis) ; **(e)** high temperature water is released ; **(f)** denaturing enzymes ; **(g)** altering rates of, chemical reactions / photosynthesis / respiration ; **(h)** lowered oxygen concentration ; **(i)** stirring up of sediment / increasing turbidity ; **(j)** (that) reduces photosynthesis / damages coral / damages gills / **AW** ; **(k)** release of, toxins / detergents / heavy metals / surfactants / acids / alkalis ; **(l)** (chemicals may) bioaccumulate / biomagnify / **AW OR** damage to gills **OR** other specific appropriate damage to organism ; **(m)** (killing of), organisms / eggs / larvae / plankton, due to entry (into desalination plant) ;	**6**	**I** reducing light intensity **I** TBT

Question	Answer	Marks	Guidance
4(a)	protecting / preserving / restoring, species / habitats / biodiversity / food webs / food chains ; preventing extinction / *idea of:* there for future generations ;	**2**	**A** ecosystem **I** environment **I** protecting animals
4(b)	*any 6 of:* **(a)** (artificial reefs) act as, nursery ground / shelter / habitat ; **(b)** *idea of:* (artificial reefs) allow development of, food, chains / webs or community **OR** (artificial reefs) increase biodiversity (of the area) ; **(c)** (artificial reefs) reduce coastal erosion ; **(d)** release of toxins / pollution from, wrecks (used to make reefs) / reefs ; **(e)** (artificial reef) may, damage sea bed / create obstacles ; **(f)** (artificial reefs) are a, long-term / sustainable, solution ; **(g)** (artificial reefs) take a long time to establish ;	**6**	**A** acts as a substrate for / allows coral growth

Question	Answer	Marks	Guidance
4(b)	**(h)** (artificial reefs) provide revenue from diving / tourism **OR** (cultivated stocks) provide revenue from increased fishing / tourist (fishing) ; **(i)** (cultivated stocks) may change, gene pool / genetics of population / alters alleles (of wild population); **(j)** (cultivated stocks) may have infections / disease ; **(k)** *idea of:* (cultured stocks) are not adapted correctly **OR** *idea of:* (cultured stock) outcompete wild fish ;		**A** descriptions of poorly adapted **A** any idea of competition **I** costs
4(c)	*any 7 of:* *Carbon neutral idea* **(a)** distinct method to reduce carbon footprints ; **(b)** to reduce use of fossil fuels / less carbon (dioxide) emissions / lower carbon footprint / carbon sequestration ; **(c)** reduced, global warming / climate change / less ocean acidification / less (coral) bleaching ; *reduction of habitat / species damage* **(d)** not using coral / careful selection of site (avoid nesting beaches etc) / restricting access / careful anchorages / responsible diving or excursions / not removing species for curios / avoiding light or noise pollution ; *Waste* **(e)** (rubbish) recycling / litter removal or disposal / stop use of plastic / use plastic alternatives / encourage tourists to remove litter / encourage taking litter home ; **(f)** less, (micro) plastic / toxins, entering food chains **OR** less negative effects of litter on marine species ; **(g)** sewage disposal or treatment / run-off disposal / restrict , detergents / fertiliser / chemicals, use ; **(h)** less, eutrophication / algal blooms / red tides / toxic waste (in sea) ;	**7**	e.g. renewable energy sources / minimising vehicles / reduction in food miles

Question	Answer	Marks	Guidance
4(c)	*Water* **(i)** recycling of water / use of grey water / water treatment ; **(j)** less need for desalination / protection of estuaries ; *Money* **(k)** sponsorship of conservation projects / money from tourism is used to maintain species diversity / local people employed / money into local economy ; *Education* **(l)** tourists / locals, gain better understanding about, (marine) conservation / (marine) environment / (marine) issues / stated marine issues ; *Food* **(m)** *idea of:* sustainable food sources / reducing, overfishing / excess agriculture / local food sources / seasonal food sources ;		**I** not eating fish