Cambridge Assessment International Education

Cambridge International AS & A Level

MARINE SCIENCE **9693/04**

Paper 4 A2 Data-Handling and Free-Response **October/November 2020**

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 October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **12** 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.

- 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
1(a)(i)	(organisms were sampled randomly) to give a representative sample / prevent bias / **AW** ;	**1**
1(a)(ii)	both axes labelled ; linear *y*-axis scale used ; accurate plots or bars (+ / 1 half square) ; lines labelled / key ; straight lines with no extrapolation ;	**5**
1(a)(iii)	*any 2 of:* bioaccumulation / biomagnification occurs / mercury accumulates along the food chain ; predators eat several, herbivores / prey, which contain mercury / **AW** ; mercury is not, excreted / broken down ;	**2**

Question	Answer	Marks
1(b)	*any 4 of:* **a** floods release mercury from river bed / levels increase after floods ; ***support*** **b** mercury higher after second flood ; **c** mercury levels are higher in some species after the ban on dredging / after 2008 / data is inconsistent ; **d** each dredge releases some mercury increasing water mercury levels; **e** dredging prevents a build-up of mercury in the estuary bed / without dredging mercury accumulates ; ***against*** **f** only one sample of mercury in organisms has been taken after the ban / experiment is on a short time scale ; **g** the invertebrate samples may have been taken after a flood ; **h** (if there is no flooding), mercury levels are very low without dredging ; **i** Table 1.1 is an indirect measure of mercury / **AW** ; **j** idea of the data is not independent and unbiased / mining company has financial interests in the study / **AW** ;	**4**

Question	Answer	Marks
2(a)	(it is supported) because as salinity of water increases, salinity of body fluids increases ; but osmoregulation occurs between 8 ppt and 16 ppt because the salinity of the body fluid is higher than the salinity of the water ;	**2**
2(b)(i)	*any 2 of:* decreases from 60% to 70% / fall from 60% to 70% ; increases between 70% and 100% ; credit relevant manipulated data ;	**2**
2(b)(ii)	*any 2 of the following factors:* volume of tank / temperature / light / feeding / oxygen / pH / tank size / **AW** ;	**1**
2(b)(iii)	*any 3 of:* crabs spend longer in 100% sea water salinity / are adapted for 100% salinity ; (idea of) behavioural osmoregulation ; in lower salinities osmosis would occur ; causing water to enter body fluids / cells of crabs ; as water moves from a higher water potential to a lower water potential / **AW** ; at 60% salinity, crabs may have become shocked / unable to move ;	**3**

Question	Answer	Marks
3(a)	***(long-term)*** ensuring catch for future generations / **AW** ; ensuring employment / money for future fishers / money for local economy ; ensuring food for future ; ***(short-term)*** loss of jobs in fishing industry / increased unemployment ; less revenue / less profit ; investing capital in fishing gear ; people leave the area ; increases in fish prices / loss of food ;	**4**

Question	Answer	Marks
3(b)	*any 7 of:* **a** sustainable fishing requires more fish entering population than leaving it / credit idea of msy ; **b** recruitment / **AW** ; **c** fecundity / **AW** ; **d** growth rates of fish ; **e** age of reproductive maturity / how long it takes to become mature / age structure / **AW** ; **f** show the number of fish entering the population ; **g** (can prevent) catch of fish that are immature / can allow fish to reach maturity / **AW** ; **h** natural mortality ; **i** fishing mortality ; **j** shows rate population reduces / deaths ; **k** breeding grounds / feeding grounds / habitat dependency ; **l** breeding seasons ; **m** restrictions can be placed on fishing in areas / breeding seasons ; **n** how damaging fishing methods are to a species ; **o** detail of how restrictions can be placed on methods, e.g. net sizes / mesh sizes / **AW** ; **p** CPUE ; **q** to see if stocks are low compared to the fishing effort / **AW** ;	**7**

Question	Answer	Marks
3(c)	*any 4 of:* ***(advantages)*** **a** protection from predators ; **b** maintenance of food chains / creates food webs / generates biodiversity for food stocks ; **c** provides a habitat ; **d** nursery ground / breeding area; **e** reduce coastal erosion / reduce wave energy ; ***(disadvantages)*** **f** encourages wrong species to cluster in areas / attracts predators ; **g** can act as underwater obstacles ; **h** can leak toxins / cause bioaccumulation of toxins ; **i** can cause fishing vessels to congregate around areas ; **j** damage to seabed ;	**4**

Question	Answer	Marks
4(a)(i)	*any 3 of:* gene for growth (from chinook salmon) ; added to promoter (from pout) ; credit reference to restriction enzymes / ligase / plasmids / microinjection / **AW** ; grow out fish in tanks and select genetically engineered ones ;	**3**
4(a)(ii)	*any 6 of:* ***(negative effects)*** **a** unsightly / affecting view ; **b** bad smell ; **c** competes for water / electricity / power / land / **AW** ; **d** reduces beach areas / areas for water sports ; **e** pollution harming fish species ; **f** escape of fish affecting biodiversity / loss of recreational fishing ; **g** competition for employment with tourism ; **h** increased traffic ; ***(positive effects)*** **i** provides cheap food for tourists / work force ; **j** may act as a tourist attraction ; **k** may improve transport links ;	**6**

Question	Answer	Marks
4(b)(ii)	*any 6 of:* **a** increasing carbon dioxide levels recorded / increase carbon emissions ; **b** increased methane levels recorded ; **c** increased use of fossil fuels ; **d** increased cattle farming / rubbish / rice farming ; **e** increased temperature links to increase in carbon dioxide / methane ; **f** reduced ice caps / glacier melting / **AW** ; **g** increase in coral bleaching ; **h** increased sea levels recorded ; **i** climate change increasing / **AW** ; **j** ice core data shows increase carbon dioxide ; **k** correlation between greenhouse gases and temperature – not causal ; **l** solar activity may affect temperature ; **m** temperature increase may be a natural cycle ; **n** volcanic eruptions could be cause of carbon dioxide increase ;	**6**