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MARINE SCIENCE **9693/41**

Paper 4 A Level Data-handling & Investigative Skills **October/November 2024**

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.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level 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 descriptions 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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)	*any **2** of:* allows dispersal to wider area / other areas / moves to different locations / **AW** ; to reduce competition / larvae have different niches from adults / **AW** ; allows (larvae to) feed on plankton / **AW** ;	**2**
1(b)(i)	533 (to 3 sig figs) ;;	**2**
1(b)(ii)	more barnacles are found on the shores where there are more phytoplankton / **ORA** ; more barnacles where there are no dogwhelks / **ORA** ;	**2**
1(b)(iii)	*any **2** of:* supported because no overlap (with and without dogwhelks) on shore with low quantities of phytoplankton / **AW** ; less support as there is an overlap (with and without dogwhelks) with larger quantities of phytoplankton / **AW** ; other factors may be affecting result / correlation not causal ;	**2**
1(b)(iv)	*any **3** of:* barnacles consume phytoplankton / more food for barnacles (if more phytoplankton) / **ORA** / **AW** ; so more survival of <u>larvae</u> ; dogwhelks reduces, <u>attachment / settling,</u> of barnacle larvae ; due to presence of, chemicals / scent, from dogwhelks / **AW** ; less reproduction of barnacles (to reduce population) (when dogwhelks present / less phytoplankton) / **AW** ;	**3**

Question	Answer	Marks
1(c)(i)	*any **3** of:* lack predators so increase in population / **AW** ; overconsume prey / **AW** ; out compete native species / **AW** ; **AVP** ;	**3**
1(c)(ii)	may become an invasive species itself / may have no predator / consume other native species / **AW** ;	**1**

Question	Answer	Marks
2(a)(i)	*any **3** of:* 1 mortality is higher (for both) during breeding season / **AW** ; 2 mortality of males is higher than females during breeding season / **AW** ; 3 mortality of males and females is similar out of breeding season / **AW** ; 4 larger <u>increase</u> in mortality of males than females during breeding season (compared with out of season) / **AW** ; 5 both have low mortality for 0–1 years / mortality increases with age / lower mortality for younger fish / **AW** ; 6 correct manipulation of data ;	**3**

Question	Answer	Marks
2(a)(ii)	*any **1** of:* female plaice are in deeper water / male plaice swim higher up the water column / males remain in the benthic area / **ORA** / **AW** ; males and females move to different, habitats / areas, (after breeding) / **AW** ; male plaice aggregate in same areas (after breeding) / **ORA** / **AW** ; male plaice are easier to catch / are targeted by fishers / females are put back by fishers / **AW** ;	**1**
2(a)(iii)	*any **1** of:* plaice (are aggregated) in one area (so are easier to find) / plaice area less dispersed / **AW** ; fishing boats target breeding areas / fishing occurs around breeding areas / **AW** ;	**1**
2(a)(iv)	*any **3** of:* 1 overfishing will reduce population / less recruitment / reduced sustainability / **AW** ; 2 fewer older / mature fish / more immature / more younger fish / **AW** ; 3 imbalanced sex ratio / too few males / **AW** ; 4 so less breeding / fertilisation / lower fecundity / fewer eggs or sperm released / **AW** ; 5 **AVP** ;	**3**
2(b)(i)	115.5 ; g ;	**2**

Question	Answer	Marks
2(b)(ii)	linear scales for both y axes and uses at least half of grid ; all axes labelled ; accurate plots ;; points joined by straight lines ; key for lines ;	**6**
2(b)(iii)	*any **3** of:* 1 lower price when GSI is high / **ORA / AW** ; 2 (may be due to) high catch rates before / during breeding season / price low when high catch / **ORA** / **AW** ; 3 (catches in breeding season causes) reduced reproduction / unsustainable fishing / population fall / less breeding / **AW** ; 4 should, ban / control, fishing during breeding season / **AW** ; 5 low price may be due to less demand for fish with high GSI / **ORA** ; 6 fish with high GSI may have lower meat content / poorer meat content / **AW / ORA** ;	**3**

Question	Answer	Marks
3(a)	*any **3** of:* 1 release of nitrogen / phosphorus ; 2 (increased) algal growth / algal blooms / eutrophication / **AW** ; 3 (covering coral so) reducing light intensity / **AW** ; 4 reducing photosynthesis (of coral) / reducing (primary) productivity / **AW** ; 5 (increased) decomposition ; 6 loss of oxygen ; 7 **AVP** ;	**3**
3(b)(i)	*any **2** of:* both decrease ; ATP levels off / reduced NADP continues to fall / **AW** ; greater fall in NADP than ATP / **ORA** / **AW** ;	**2**
3(b)(ii)	*any **3** of:* less <u>light-dependent stage</u> ; less light trapped by chlorophyll / less photoactivation of chlorophyll / **AW** ; less transfer of <u>energy</u> from, light / chlorophyll, to ATP / reduced NADP ; some ATP continues to be produced via respiration ; **AVP** ;	**3**

Question	Answer	Marks
3(b)(iii)	*any **3** of:* glucose concentration falls / **AW** ; light-independent stage does not occur ; due to loss of ATP / reduced NADP ; less fixation of carbon / **AW** ; glucose is used in respiration ; glucose is converted to starch / organic molecules / other named substance ;	**3**
3(c)	lines are thin, clear, unbroken and no shading ; at least one third of space used ; correct proportions of cell width, length and chloroplasts ; correct detail ; *correct number of chloroplasts (minimum of 8) **+** double line for cell wall ;*	**4**

Question	Answer	Marks
4(a)	*any **3** of:* (increased) carbon dioxide / methane in atmosphere ; short wavelength, light / radiation, passes through atmosphere (to ground) / **AW** ; longer wavelength light reflects back into atmosphere ; heat / radiation / (IR) light, trapped in atmosphere / **AW** ;	**3**

Question	Answer	Marks
4(b)(i)	54–56 % ;	**1**
4(b)(ii)	*any **3** of:* 1 increased proportion of females / more female turtles / fewer males ; 2 less breeding / less reproduction / **AW** ; 3 decreased populations ; 4 flooding of beaches / sea level rise, reducing nesting sites ; 5 food chains affected / less food / food matures at different times / **AW** ;	**3**
4(c)(i)	42.5 ;	1
4(c)(ii)	805 to 975 ;	**1**
4(c)(iii)	*any **3** of:* there is no overlap between the confidence intervals ; there is a <u>significant difference</u> between means ; so there is an increase in population ; probability of <0.05 that the difference is due to chance / **AW** ;	**3**

Question	Answer	Marks
5(a)	*any **3** of:* 1 tuna is an osmoregulator ; 2 salinity / salt concentration, of sea water is higher than body fluids / **ORA** / **AW** ; 3 water potential of sea water is lower than body fluids / **ORA** / **AW** ; 4 so water leaves (tuna) / **AW** ; 5 by osmosis ;	**3**

Question	Answer	Marks
5(b)	*hypothesis* kelp from estuary will have a higher water potential than kelp from a rocky shore / **AW** ; *plus any **10** from:* *independent variable:* estuary compared with rocky shore / concentration of sea water / water potential of sea water / **AW** ; *dependent variable* water potential of kelp / **AW** ; *standardised variables* *max **3** of:* same mass / surface area / volume of kelp / same size pieces / **AW** ; same species of kelp / age of kelp / **AW** ; collect at same time of year / time of day / same season / **AW** ; same temperature (to do lab experiment) ; same volumes of solutions (in lab experiment) ; same period of time to leave kelp in solutions / **AW** ;	**11**

Question	Answer	Marks
5(b)	*method* *max **3** of:* placing kelp in minimum of five different salt concentrations ; weighing kelp before **and** after placing into solutions / viewing cells under microscope and counting plasmolysed cells / **AW ;** use of balance / use of microscope ; *ref. to* correct range of concentrations ; **AVP** ; *Analysis* *max **3** of:* replicate experiment and calculate, means / standard deviations / **AW** ; calculate <u>percentage</u> change of mass / percentage of cells plasmolysed ; plot graph of percentage change in mass against salinity / percentage plasmolysis against salinity ; read off salinity where percentage change in mass is 0 / plasmolysis is 50 % / **AW** ; example of results table ; use of correct statistical test, e.g. confidence limits / t test ; *safety and ethics* correct safety precaution linked to risk / statement that experiment is low risk / **AW** ; do not remove large amounts of kelp from sea / do not wash contaminated solutions down sink / ensure no other organisms taken with kelp / **AW** ;	