CAMBRIDGE
International Education

Cambridge International AS & A Level

MARINE SCIENCE **9693/22**

Paper 2 AS Level Data-handling and Investigative Skills **May/June 2026**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **17** printed pages.

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

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	<u>'List rule' guidance</u> 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.

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

6	<u>Calculation specific guidance</u> 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	<u>Guidance for chemical equations</u> 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.

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
✓	correct point or mark awarded
✗	incorrect point or mark not awarded
^	information missing or insufficient for credit
A	allow or accept
I	incorrect or insufficient point ignored while marking the rest of the response
CON	contradiction in response, mark not awarded
BOD	benefit of the doubt given
ECF	error carried forward applied
MR	maximum mark reached
PAG	Point already given

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Annotation	Meaning
POT	power of ten error
R	incorrect point or mark not awarded
RE	rounding error
SEEN	point has been noted, but no credit has been given or blank page seen
TV	response is too vague or there is insufficient detail in response
1, 1, a	marking point 1 or marking point a is awarded. Used to mark against a particular marking point from an extended answer MS
	used to highlight parts of an answer / incorrect idea / irrelevant to question
	used to highlight parts of an extended response / incorrect idea / irrelevant to question
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
ruler	allows lengths to be measured
multi-line overlay	overlays graphs

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
1(a)	clear continuous outline with thin lines with no shading and no gaps ; suitable size ; in proportion ; detail ;	4	**I** markings **Max three marks if clearly drawn in pen (R mp1)** outer outline and opening needs to be continuous, plate lines can have gaps at least size of image outer edge approximately spherical opening diamond shaped opening 'length' not less than a third of barnacle diameter opening 'width' not more than a third of diameter. two top left opening plates smaller than two bottom right attempt at drawing ornate outer edge four plates in opening, correct s-shape between larger and smaller plates
1(b)(i)	*(idea that)* mean barnacle diameter or mean percentage cover is not affected by the angle of the surface / **AW** ;	1	**A** barnacle diameter / percentage cover **A** if both included **A** no correlation between angle of surface and mean barnacle diameter / mean percentage cover **I** no correlation unqualified **I** rock surface unqualified **I** correlation between diameter and % cover

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
1(b)(ii)	use of quadrat ; description of how to make it random **OR** systematic ; estimate percentage of rock covered in barnacles ; repeat for minimum of 3 quadrats **+** calculate mean ;	**4**	**R** quadrants e.g. transect for systematic (at suitable specified distances) or random number generator and use of a grid for random. Simple ref. to random or systematic sampling alone is not enough **A** any description that would allow for determining % cover **I** calculate area of one barnacle and multiply by number
1(b)(iii)	total for (20 largest) barnacles added together **+** divide total by 20 ;	**1**	
1(b)(iv)	ensure barnacles measured are (more likely to be) fully grown ; (idea of) ensures sample is representative of overall population ;	**2**	**A** smaller / juvenile barnacles may not be fully grown **A** allows a fair comparison **OWTTE** ; **I** to reduce bias **I** to reduce error **I** larger barnacles are easier to measure accurately **I** avoids anomalies **I** more precise
1(b)(v)	both mean diameter AND percentage cover greater for horizontal surface ; data manipulated to show 11% diff in percentage cover 2.5 mm diff diameter ;	**2**	**I** more barnacles for % cover **A** correct percentage differences **A** for 1 mark correct comparison and calculation for one data pair only

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
1(b)(vi)	*any **3** of:* vertical surface exposed to greater wave action ; more energy expended clinging / adhering to rock surface / thickening plates ; so less energy available for growth ; probability of settling on horizontal surface is higher ; larger barnacles will cover a greater area so % cover will be higher ; **AVP** ;	**3**	**R** refs to light **A** harder to remain attached to vertical surface energy only needed once if awarding mp 2 and 3 Temperature is higher on horizontal surface or more water is retained on the horizontal surface which may be beneficial to barnacles **I** greater reproductive success

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
2(a)(i)	mass of salt (dissolved in sample) ;	1	'Salt' insufficient
2(a)(ii)	heat / boil, water to evaporate the water ; until constant mass / no water remains ; valid description to determine mass ;	3	**A** for mp1 and mp2 'heat until, all the water evaporates / only salt remains' **A** reference to not losing mass of salt during heating e.g. calculate mass of salt by subtracting the mass of empty beaker from the mass of the beaker plus salt OR transfer to separate vessel to weigh
2(b)(i)	17(.0) ; ;	2	**A** for 1 mark 200 cm^3 = 0.2 dm^3 **ECF** for 1 mark 3.4 / 200 = 0.017
2(b)(ii)	correct labels and units for y axis ; linear scale chosen for y axis ; 5 given plots correct ; line / curve of best fit for surface of estuary ;	4	y-axis must go to at least 35 must be at least 2 correct scale values **R** rulered lines / point-to-point lines **A** ignoring apparent anomaly

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
2(b)(iii)	*any **3** of:* greater (rate of) decrease in density at surface of estuary ; surface of estuary drops 20 g per dm^3 compared to only 9.5 at bottom ; density at bottom does not change for last 2 hours ; density at surface is lower than density at bottom **OR** both decrease over the period ;	**3**	**A** any manipulated comparison of data
2(b)(iv)	decrease in both must be due to, falling tide / less ocean water ; density at surface drops more due to higher proportion of fresh water / **ORA** ; *(due to)* salt water is denser than freshwater ;	**3**	**I** precipitation

Question	Answer	Marks	Guidance
3(a)(i)	community of organisms ; interacting with each other **AND** physical environment / habitat ;	**2**	**A** all the living organisms / species **I** surroundings / home **A** 'living organisms and their environment' for 1 mark

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
3(a)(ii)	*any **1** of:* fringing reef found along coastlines, patch reefs are found offshore ; fringing reef separated from shore by shallow lagoon, patch reef by, open ocean / deeper lagoon ; **AVP** ;	**1**	must be comparative, single statement insufficient **A** fringing reefs below 20 m **AND** patch reefs above 20m / shallower e.g. patch reefs usually smaller / isolated area or patch reefs rarely reach surface of water
3(a)(iii)	*any **1** similarity from:* both composed of polyps ; both have, nematocysts / mouth / tentacles / stomach ; *any **1** difference from:* hard corals have, calcium carbonate skeleton / much higher degree of calcification ; hard corals withdraw into skeleton, soft corals chemical defence / toxicity ; **AVP** ;	**2**	**A** stinging cells / cnidocyte / cnidocyst **A** soft corals held together by sclerites / possess gorgorin / possess spicules e.g. hard corals have 6-fold symmetry, soft corals 8-fold symmetry ;
3(b)(i)	cm s^{-1} ;	**1**	**A** m s^{-1} / km h^{-1} / knots / m h^{-1} **A** m/s type notations **R** if imperial units

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
3(b)(ii)	*any **4** of;* supported by two out of three (pinnacle and fringing) reefs / not supported by patch reef ; other factors may be causing differences / correlation does not mean causation ; not clear how many of each reefs were studied ; not clear how many repeats were made for each current speed ; not all current speeds were studied on all reefs ; (idea of) more limited range of current speeds recorded for pinnacle reef ;	**4**	**A** lots of the data is extrapolated
3(b)(iii)	uses number of individuals as well as number of species ;	**1**	**I** Simpsons index is calculated, better than extrapolated data
3(b)(iv)	columns for species **+** abundance **/** number of individuals ;	**1**	**A** n for number of individuals **R** species 1,2,3 etc written in column **I** columns for Simpsons index
3(b)(v)	*any **2** of:* faster current may bring more nutrients into ecosystem ; faster current may bring more larvae; faster current may bring more planktonic food into ecosystem ; smaller species may not be able to swim in faster current ; **AVP** ;	**2**	 **A** oxygen for nutrients **A** removing waste e.g. heat distribution

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
3(c)	*any **1** of*: atoll ; barrier (reef) ;	**1**	

Question	Answer	Marks	Guidance
4(a)(i)	intertidal region ; between highest and lowest spring tides ;	**2**	 **A** highest high and lowest low tides. (tides unqualified insufficient)
4(a)(ii)	ref. to gravitational pull from moon AND Sun attracting water ; ref. to rotation of the Earth ;	**2**	**I** refs to alignment / Spring / neap
4(b)(i)	*any **3** of:* in summer temperature of water rises (greatly) then falls AND in winter temperature of water drops then rises ; drop in winter not as great as rise in summer ; water temperature in winter always lower than temperature in summer ; use of processed data to support answer ; **AVP** ;	**3**	**I** start and end at similar temps Summer rise = 22.6 -10.8 = 11.8 Winter fall = 9.6 – 6.7 = 2.9 e.g. The minimum water temperature in the winter is an hour later (14:00) than the maximum water temperature in the summer (13:00)

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
4(b)(ii)	*any **2** of:* when tidepool uncovered in summer, (radiation from) Sun / high air temperature heats water ; in winter tidepool loses heat to colder surroundings ; water returns to original temperature when tide rises ; ref. to greater difference between air and water temp giving, further to rise / less far to fall ; **AVP** ;	**2**	**I** differences in light intensity **A** air temperature is higher in summer ORA for 1 mark **A** in winter air does not warm up as much / for as long
4(c)(i)	13:00 ;	**1**	**A** 1pm or 1 o'clock (as 1am not on graph)
4(c)(ii)	(*idea of*) time by which most evaporation will have occurred (prior to pool being recovered) / **AW** ;	**1**	**I** hottest time of day
4(d)(i)	oxygen being used up by, respiration / respiring organisms ; no oxygen added by photosynthesis in dark ;	**2**	**R** refs to heating effect on solubility **A** rate of respiration exceeds rate of photosynthesis for two marks
4(d)(ii)	940 and 280 read off the graph ; (660 / 280 × 100 =) 235.71428571 % ; calculated answer correctly stated to 3 sig. figs ;	**3**	1 mark for 3 sig figs if calculation attempted 2 marks for 235.71…with no working 3 marks for 236 with no working 2 marks 235 with no working 2 marks for 70.2 or 193 WITH working **ECF** for mp2 for correct % increase from incorrect readings

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
4(d)(iii)	*any **4** of:* higher light intensity during the day increases the rate of photosynthesis ; oxygen concentration falls at 15:00 due to the light intensity decreasing ; at the start of C, the water becomes, isolated / exposed again so oxygen concentration can change ; tidal pool exposed so temperature increases ; rate of photosynthesis initially increases as temperature increases ; so oxygen concentration increases ; oxygen concentration later in day falls due to respiration rate exceeding photosynthetic rate ; oxygen concentration falls due to lower solubility at higher temperatures ; **AVP** ;	**4**	**A** Organisms living in the tidal pool could be under stress and respiring more so reducing the concentration of oxygen.

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026

Question	Answer	Marks	Guidance
5(a)(i)	*any **2** of*: (synthesis of), chlorophyll ; amino acids / protein ; nucleic acid / DNA ; **AVP** ;	**2**	 **A** other named protein **A** other named nucleic acids **A** ATP / ADP
5(a)(ii)	NO_3^- ;	**1**	**R** NO^{3-}
5(b)(i)	carbon dioxide + water → glucose + oxygen ;	**1**	Reactants / product pairs can be either way around **I** sunlight, chlorophyll (on the left hand side of the equation) **A** fully balanced symbol equation **R** a written sentence / =, must be an arrow and + signs **R** mixed word and symbols
5(b)(ii)	*any **3** of:* photosynthesis rate high in early part of day to generate glucose / carbohydrate ; photosynthesis slows in middle of day to prevent high oxygen concentration in cells ; nitrogen fixation not inhibited / nitrogen availability increases ; increased production of biomass ;	**3**	

© Cambridge University Press & Assessment 2026

PapaCambridge · papacambridge.com 9693/22 Mark Scheme June 2026