



National
Qualifications
2025

2025 Environmental Science

Higher Paper 1

Question Paper Finalised Marking Instructions

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General marking principles for Environmental Science Higher

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you should seek guidance from your team leader.
- (c) Where a candidate makes an error at an early stage in a multi-stage calculation, award marks for correct follow-on working in subsequent stages. Do not award marks if the error significantly reduces the complexity of the remaining stages. Apply the same principle in questions that require several stages of non-mathematical reasoning.
- (d) Award full marks for a correct final answer (including units if required) on its own with no working shown.
- (e) Candidates may access larger mark allocations fully, whether they respond in continuous prose, linked statements, or a series of discrete developed points.
- (f) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (g) In the detailed marking instructions, words separated by / are alternatives.
- (h) Do not award marks if a candidate gives two answers, where one is correct and the other is incorrect.
- (i) Where the candidate is instructed to choose one question to answer but instead answers both questions, mark both responses and award the better mark.
- (j) Award marks for a valid response, even if the response is not presented in the format expected. For example, award the mark if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested.
- (k) Candidates may use abbreviations (for example, BOD or GPP) or chemical formulae (for example, CO₂ or H₂O) as acceptable alternatives to naming, unless required by the question, but these must be correct. For instance, chemical formulae with an incorrect subscript or superscript component (for example CO²), or full-size number (for example CO2) should not be awarded the mark.
- (l) Award marks, up to the maximum mark allocation for the question, for content that is outwith the course specification but used appropriately at the correct level for Higher.
- (m) If candidates are required to give a numerical answer, and units are not given in the stem of the question or the answer space, they must supply the units to gain the mark.
- (n) If incorrect **spelling** is used:
 - and the term is recognisable, then award the mark;
 - and the term can easily be confused with another scientific term, then do not award the mark, for example bioaccumulation and biomagnification, or qualitative and quantitative;
 - and the term is a mixture of other terms, then do not award the mark.

- (o) When presenting data:
- for marking purposes no distinction is made between bar charts (used to show discontinuous features, have descriptions on the x -axis and have separate columns) and histograms (used to show continuous features, have ranges of numbers on the x -axis and have contiguous columns)
 - other than in the case of bar charts/histograms, if the question asks for a particular type of graph or chart and the wrong type is given, then do not award the plotting mark. Marks may still be awarded for other required components, as specified in the detailed marking instructions.
 - do not award the relevant mark if the graph too small to check the accuracy of plotting; or if 0 is plotted when no data for this is given (ie candidates should only plot the data given)
- (p) Award marks only for a valid response to the question asked. For example, in response to questions that ask candidates to:
- **identify, name, give, or state**, they need only name or present in brief form;
 - **define**, they should give a statement of the definition;
 - **calculate**, they must determine a number from given facts, figures, or information;
 - **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
 - **describe**, they must provide a statement or structure of characteristics and/or features;
 - **evaluate**, they must make a judgement based on criteria;
 - **explain**, they must relate cause and effect and/or make relationships between things clear;
 - **justify**, they must give reasons to support their suggestions or conclusions;
 - **discuss**, they must write about a topic in detail, taking into account different issues or ideas;
 - **outline**, they must provide a brief sketch of content - more than naming but not a detailed description;
 - **predict**, they must suggest what may happen based on available information;
 - **suggest**, they must apply their knowledge and understanding of Environmental Science to a new situation. A number of responses are acceptable: marks will be awarded for any suggestions that are supported by knowledge and understanding of Environmental Science.

Note that this list is not exhaustive.

Marking instructions for each question

Question		Expected response	Max mark	Additional guidance
1.	(a)	Offers food/shelter/breeding environment (in an area where marine biomass is low).	1	Accept valid reference to nutrients. Do not accept provides a habitat. Do not accept increases biomass on its own - must convey benefit of increased biomass.
	(b) (i)	(Photosynthesis requires light energy so) most rooted marine plants will be restricted to shallow water/ limited by light penetration through water. Or other valid response.	1	
	(ii)	The rate at which an ecosystem accumulates energy/biomass, excluding the energy used for respiration.	1	Must refer to loss of energy via respiration. Accept: $NPP = GPP - \text{respiration}$.
	(iii)	$27\,525\,000\,000\,000\text{ kg}/$ $27.525 \times 10^{12} \text{ (kg)}/2.7525 \times 10^{13} \text{ (kg)}$	2	7.50×10^{12} (1 mark) $(7.50 \times 10^{12}) \times 3.67$ Accept: 2.8×10^{13} , 2.75×10^{13} , 2.753×10^{13} Allow for error carried forward eg omission of 10^{12} or 10^{13} (1 mark)

Question		Expected response	Max mark	Additional guidance
2.	(a)	A major spiral of ocean-circling current (that occurs north and south of the equator).	1	Must convey scale.
	(b)	The circulating movement of the gyre should trap the <i>Sargassum</i> / the <i>Sargassum</i> should not survive due to low nutrient availability away from the aquafarm/or other valid response.	1	
	(c)	(i) The pumped cold water will warm/ become less dense as it rises up the pipe, (1 mark) and will continue to pull up colder/ denser water from the lower layer so long as differences in temperature exist. (1 mark)	2	Do not accept nutrients or pressure as being the driver.
		(ii) Temperature is relatively stable (7.5-10 °C) between 500-300 m, then increases (10-30 °C) until around 100 m, after which it becomes more stable. OR Salinity is relatively stable (around 34.5 g l ⁻¹) between 500-400 m, then decreases (approx. 34.25 g l ⁻¹) until around 300 m, before increasing (approx. 35.1 g l ⁻¹) until around 150 m, after which it decreases up to sea level.	2	1 mark for describing the relationship between depth and temperature/salinity. 1 mark for approx. depth points where changes occur; these must be appropriate to the description.
		(iii) Temperature/salinity/weather conditions in the Pacific Ocean may be very different to those in the South Atlantic Ocean. Or other valid response.	1	Accept: Pipe length was different. Do not accept: conducted in different oceans unless further expanded eg differences.

Question		Expected response	Max mark	Additional guidance
3.	(a)	<p>It stores/sequesters the carbon, so less contribution to climate change.</p> <p>Or other valid response.</p>	1	<p>Accept: provides habitats, so increases biodiversity.</p> <p>Do not accept reduces CO₂ emissions on its own.</p> <p>Do not accept: release of nutrients as bales decompose.</p>
	(b)	<p>Tectonic activity could dislodge the bales.</p> <p>OR</p> <p>A storm could break up the <i>Sargassum</i> raft/dislodge the pipes.</p> <p>Or other valid response.</p>	1	<p>Do not accept: a storm could break up the bales.</p> <p>Do not accept tsunami without a justified impact on the project.</p>
	(c)	<p>Makes use of a waste product, so less waste management involved/reduces visual impact/reduces odour impact/reduces flies.</p> <p>OR</p> <p>Using a waste product to produce biogas/generate energy reduces reliance on fossil fuels.</p> <p>Or other valid response.</p>	1	<p>Do not accept is a renewable resource on its own.</p> <p>Accept: biogas production is not from a food source so doesn't compete with food production.</p> <p>Accept: is an alternative energy source so can increase energy security.</p>

Question	Expected response	Max mark	Additional guidance
4.	<p>Yes</p> <ul style="list-style-type: none"> • <i>Sargassum</i> has a very high productivity rate and can be harvested for profit/carbon credits • <i>Sargassum</i> has a high annual carbon sequestration rate, so can help minimise climate change • storing the bales on the seafloor will sequester carbon and so help minimise climate change • the <i>Sargassum</i> raft will offer a valuable habitat for marine species in an area where marine biomass is low • bringing nutrient-rich water up from deeper waters means there is no need for artificial fertilisers, so reduces cost • the gyre/low nutrient availability should prevent the <i>Sargassum</i> escaping and becoming a nuisance to coastal communities • if the <i>Sargassum</i> does escape and washes up on beaches, it can have many uses (eg named example) Example: the <i>Sargassum</i> can be processed for renewable energy generation (eg hydrogen production, syngas, biofuel), so help minimise climate change/reduce dependence on fossil fuels <p>Or other valid response.</p>	5	<p>1 mark for each valid <u>expanded</u> point that relates to the selected option.</p> <p>Focus must be on the project aim of sequestering carbon.</p> <p>Maximum of 1 mark for consequences of escape (uses of <i>Sargassum</i>) unless explicitly related to the project.</p> <p>Candidates may cite statements from the information provided, but these must be discussed further. No marks awarded for simply stating information provided.</p> <p>Discussion may offer counter-arguments for either option (eg escape of <i>Sargassum</i> in North Atlantic) but should conclude with which one of the options should be adopted.</p>

Question	Expected response	Max mark	Additional guidance
4.	(continued)		
		<p>No</p> <ul style="list-style-type: none"> • changing weather conditions (due to climate change) may reduce productivity, leaving the aquafarm unprofitable • climate change may result in more/unpredictable storms, which could break up the aquafarm • the company could be wrong about the gyre containing the <i>Sargassum</i>/the <i>Sargassum</i> not surviving outside the gyre • <i>Sargassum</i> escaping the gyre/ washing up on beaches could have a detrimental impact on coastal communities/biodiversity • the bales stored on the seabed could be disturbed sufficiently to release the sequestered CO₂ • it's an experimental setup/has not been fully tested and there are too many unknowns/potential problems/technical and scientific uncertainties • saltmarsh has a higher mean annual carbon sequestration value, so would be a better option for investment <p>Or other valid response.</p>	

[END OF MARKING INSTRUCTIONS]