National
Qualifications
2024

2024 Environmental Science

Higher – Paper 1

Question Paper Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

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, CO_2 or H_2O) 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 CO^2), 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.			Responsible for (forest) policy/ support/legislation.	**1**	Must relate to Scottish Forestry, not Forestry & Land Scotland.
2.			Forestry and timber processing.	**1**	Evidence of calculation is not required. Forestry and timber processing = £39,427 per employee. Forest recreation and tourism = £28,992 per employee.
3.	(a)		Letting the trees grow for 40 years means more timber per tree. **(1 mark)** The risk for windbreak/tree trunks snapping stabilises around 35 – 40 years. **(1 mark)** The risk of windthrow/uprooting of trees stabilises between 40 to 50 years. **(1 mark)** The tree flexibility diagram suggests that a tree trunk is most at risk (during a gust event) around 45 years. **(1 mark)** 40 years is around the point where profit and risk are balanced. **(1 mark)**	**3**	Response must refer to windbreak and windthrow. Max of 2 marks if no age values are included.
	(b)	(i)	Loss of trees/canopy allows light to penetrate and enables new plant species to germinate at lower levels. Or other valid response.	**1**	Do not accept only 'allows light to penetrate'. Must refer to new/other plants. Accept reference to secondary succession, with further discussion.
		(ii)	Increase in type of plants increases biodiversity. **OR** Increase in type/abundance of plants offers shelter/food for organisms, and biodiversity will increase. Or other valid response.	**1**	

Question			Expected response	Max mark	Additional guidance
3.	(c)	(i)	Hardwoods tend to have larger canopies than softwoods, **(1 mark)** so require more space. **(1 mark)** **OR** Softwoods are harvested earlier and don't grow as large, **(1 mark)** so can be planted closer together. **(1 mark)** **OR** Planting stems close together forces trees to grow towards the light, (**1 mark**) producing tall/straight trunks. **(1 mark)** Or other valid response.	**2**	
		(ii)	The likelihood of contact increases with density. **(1 mark)** Increased contact can result in more/greater damage. **(1 mark)** Or other valid response.	**2**	Must infer contact.
4.			*R. ponticum* (is an invasive non-native species/INNS that) outcompetes native species. **OR** *R. ponticum* is susceptible to Ramorum disease, which can also infect many of the (native) tree species. Or other valid response.	**1**	Do not accept only 'the plant is an invasive non-native species'. Must be a fuller explanation.

Question			Expected response	Max mark	Additional guidance
5.	(a)		(-)11 (%)	**2**	1 mark for calculating carbon sequestered by each species. 1 mark for percentage difference. Sitka spruce: 13.2 × 55 = 726 Beech: 8.8 × 92 = 810 $\frac{(726-810)}{\left[\frac{(726+810)}{2}\right]}\times 100$ Accept 10.9 or 10.94 If unrounded value (809.6) used for beech, accept 10.89
	(b)		Beech – has a lower carbon sequestration rate than Sitka spruce but a longer crop rotation time, so will store carbon for longer.	**1**	Mark is for valid justification. Accept use of values from (a) as part of justification.

Question			Expected response	Max mark	Additional guidance
6.			**Habitats and biodiversity** Some of the hardwoods in the restocking plan have both wildlife and commercial value, but the hardwood planting density would offer greater benefit to biodiversity. **(1 mark)** Ramorum disease has been detected (in *R. ponticum*) and can badly affect tree species listed in the restocking plan, so it is better to plant a broader range of species that are not affected by the disease. (**1 mark**) The UK's climate is predicted to become more extreme/wetter/ windier in the future, so it is better to plant a broader range of species. **(1 mark)** The LBAP survey found that many of the estate's wildlife species are of UK importance/listed on the UKBAP, so the estate should strengthen this by expanding habitat for these species. **(1 mark)** It would be visually more pleasing to have a stand of hardwoods/ mixed woodland in the centre of the park than densely planted conifers. **(1 mark)** In the longer term, the carbon sequestration rates will be greater so it will help mitigate climate change. **(1 mark)** Or other valid response.	**5**	1 mark for each valid <u>expanded</u> point that relates to the selected option. Candidates may cite statements from the information provided, but these must then be discussed further. No marks awarded for simply stating information provided. Discussion may offer counter-arguments for either option but should conclude with which one of the options should be adopted. Do not accept points that are relevant for both options, eg trees will sequester carbon.

Question			Expected response	Max mark	Additional guidance
6.			**Commercial income** Scotland's Forestry Strategy predicts that importation of wood/wood products will increase (to 78% by 2040)/global demand will increase/ prices will increase, so timber species should be grown in the UK/ on the estate to meet demand. **(1 mark)** Both hardwoods and softwoods have commercial income potential, so planting hardwoods or softwoods or a mix would all generate income, (**1 mark**) Softwoods have a shorter optimum rotation period, so would generate income in approx. half the time of hardwoods. **(1 mark)** Hardwoods are an important resource (for wood fuel, crafts and construction), so the estate could plant these to maximise longer term income. **(1 mark)** The forest and timber processing sector contributes more to the Scottish economy than the forest recreation and tourism sector, so the estate could build on this. **(1 mark)** Scotland has good growing conditions for timber species and a highly efficient processing sector, so the estate should try to maximise financial benefits from this. (**1 mark**) Timber is a renewable source of energy and is important for delivery of the Scottish Energy Strategy. (**1 mark**) The LBAP indicates the estate already includes a diverse range of habitats/has an abundance of wildlife, so replanting with softwood species should not impact that. **(1 mark)** Or other valid response.		

[END OF MARKING INSTRUCTIONS]