Course report 2023

Higher Environmental Science

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative, and to promote better understanding. You should read the report in conjunction with the published assessment documents and marking instructions.

The statistics in the report were compiled before any appeals were completed.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2022: 543

Number of resulted entries in 2023: 587

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	80	Percentage	13.6	Cumulative percentage	13.6	Minimum mark required	77
B	Number of candidates	118	Percentage	20.1	Cumulative percentage	33.7	Minimum mark required	63
C	Number of candidates	151	Percentage	25.7	Cumulative percentage	59.5	Minimum mark required	49
D	Number of candidates	131	Percentage	22.3	Cumulative percentage	81.8	Minimum mark required	35
No award	Number of candidates	107	Percentage	18.2	Cumulative percentage	100	Minimum mark required	N/A

Please note that rounding has not been applied to these statistics.

You can read the general commentary on grade boundaries in the appendix.

In this report:

- ‘most’ means greater than 70%
- ‘many’ means 50% to 69%
- ‘some’ means 25% to 49%
- ‘a few’ means less than 25%

You can find more statistical reports on the statistics and information page of SQA’s website.

Section 1: comments on the assessment

Question papers

Feedback from the marking team and teachers and lecturers indicated that they considered both papers to be fair and accessible for candidates.

Some observations apparent across both papers include the following:

- There was a notable increase in the number of no responses this year. This is common for calculations, but basic recall questions were also frequently avoided. The number and pattern of the non-responses indicates significant gaps in knowledge and skills, rather than a time issue.
- Most candidates taking Higher Environmental Science have no prior attainment in the subject.
- A poor standard of literacy and numeracy skills, both basic and scientific, was evident. All candidates should have developed literacy and numeracy skills commensurate with at least Higher level.
- Poorly developed knowledge and understanding of environmental science commensurate with Higher was frequently demonstrated by difficulties in defining basic environmental science terms (for example, sustainability, waste hierarchy, food security, net primary productivity, and upwelling).
- Candidates frequently did not access marks because they had not provided sufficiently detailed descriptions or explanations or had not completed calculations as directed (for example, rounding of calculated values). It was evident that some candidates had not read the questions carefully before answering.
- Some candidates provided multiple responses to individual questions. The general marking principles for environmental science clearly state that ‘marks should not be awarded if the candidate gives two answers, where one is correct and the other incorrect’, since the incorrect response negates the correct one.

Question paper 1

Question paper 1 focuses on an application of environmental science and has an intentional focus on problem solving.

Candidates usually perform strongly in the case study, especially the final decision-making question. On this occasion, the paper did not perform as expected, and an overall mark adjustment was made to the grade boundary to reflect this.

Question paper 2

Question paper 2 followed the same format as question papers in previous years.

Some questions proved to be more demanding than intended, including question 2(a), question 5(a), and question 8(a)(ii), and mark adjustments were made to the grade boundary.

Assignment

The requirement to complete the assignment was removed for session 2022–23.

Section 2: comments on candidate performance

Areas that candidates performed well in

The following comments identify questions where candidates performed well.

Question paper 1

Question 3	Describing impacts of disturbing drill cuttings. Most candidates were able to provide one valid description of potential impacts, and many could describe two.
Question 5(b)	Explaining the need for sustainable harvesting practices. Most candidates demonstrated a good understanding of the need for sustainable harvesting practices.

Question paper 2

Question 1(a)	Stating a reason for the increasing global demand for farmed meat. Most candidates provided a valid reason.
Question 1(c)(iii)	Suggesting why farmers on mainland Scotland may not be able to adopt the practice demonstrated by farmers on North Ronaldsay. Most candidates provided a valid response, typically relating to access to seaweed.
Question 1(d)(ii)	Calculating the maximum mass of salmon able to be farmed in one of the cages. Most candidates correctly calculated the volume of the cage and substituted values into the formula and were awarded 2 marks. However, only some candidates achieved full marks by completing the calculation, including rounding their calculated value to the nearest 1000 kg as directed.
Question 1(d)(iii)	Suggesting a benefit of establishing new salmon farms. Many candidates suggested a valid benefit, with most focusing on increased employment.
Question 3(a)(i)	Identifying the tree species with the longest uninterrupted presence of pollen in the core sample. Many candidates identified the correct species.
Question 3(a)(ii)	Naming the tree species not represented in the top 50 cm of the core sample. Most candidates were able to name the correct tree species.
Question 3(c)(ii)	Concluding which birch species is most likely to be found at the survey site. Most candidates correctly identified the species and provided valid justification.

Question 4(a)(i) Identifying the biome.
Most candidates correctly identified the biome using the values provided.

Question 4(b)(iv) Identifying the biome with the greatest net primary productivity.
Most candidates were able to use the three graphs to identify the correct biome and many were able to justify their choice appropriately.

Question 6(e)(ii) Suggesting an issue that may discourage consumers from transitioning to electric vehicles.
Most candidates suggested a valid issue.

Question 7(b)(i) Stating the source of a named anthropogenic greenhouse gas in a city.
Most candidates correctly named a greenhouse gas and its source of emissions in a city.

Question 7(b)(ii) Suggesting why individuals in rural communities account for more emissions than those in urban areas.
Most candidates provided a valid reason for the difference in emissions.

Question 7(c)(ii) Suggesting a government action that resulted in lower emissions during the pandemic.
Most candidates provided valid suggestions, often linked to their own experiences during the pandemic.

Areas that candidates found demanding

The following comments identify questions where candidates did not perform well, or areas of particular concern.

Question paper 1

Question 1(a)(i) Stating why legislation is necessary.
Most candidates were unable to provide a valid reason why legislation is necessary.
Candidates may have been confused by being asked for 'one reason' in the question, rather than 'the reason'.

Question 1(a)(ii) Naming the environmental agency with responsibility for integrated management of Scotland's seas.
Most candidates were unable to name the correct agency, with most incorrectly stating SEPA.

Question 1(a)(iii) Describing the purpose of an EIA.
Most candidates correctly focused on the need to identify significant environmental impacts but omitted reference to mitigation.

Question 1(a)(iv) Outlining why the bird count data might not be valid.
Few candidates identified the need to control variables (for example, same length of survey periods) or the inability to control the variables (for example, weather conditions).

Question 1(b)(i) Stating the role of an MPA designation.
Information was provided in the supplementary booklet (Source C), but most candidates either omitted mention of the marine environment or demonstrated limited knowledge of what is protected by an MPA designation (wildlife, habitats, geology, undersea landforms).

Question 2(a) Describing what is meant by the waste hierarchy.
Most candidates omitted reference to the environment in their response.

Question 5(a) Calculating percentage change.
Few candidates achieved both marks. Most either did not complete the calculation or did not state that it was a decrease.

Question paper 2

Question 1(b)(i) Stating a source of methane.
Most candidates did not provide a valid source. Many incorrectly stated ‘landfill’ rather than decomposing (organic) waste in landfill.

Question 1(b)(ii) Explaining an economic benefit of reducing the volume of methane produced in agriculture.
Many candidates either did not attempt this question or did not achieve a mark. The most common omission was any reference to an economic benefit.

Question 1(c)(i) Stating what is meant by food security.
Most candidates provided incorrect or insufficient responses, often missing the scale of access (that is, population rather than individual).

Question 1(d)(i) Suggesting an environmental benefit of reduced sea lice.
Many candidates omitted to refer to an environmental benefit, often commenting on a benefit to caged fish or incorrect reference to caged fish being able to reproduce.

Question 2(a) Defining sustainability.
Few candidates provided an appropriate definition of sustainability, with most defining sustainable development instead.
Guidance on both sustainability and sustainable development is provided in the course specification (and glossary) and candidates should familiarise themselves with both terms.

Question 2(b)(iii) Stating two additional pieces of information required to complete an LCA.
While many candidates stated one valid piece of information, few were able to state two.

Question 3(c)(i) Explaining the limited presence of ash pollen, using a named edaphic factor.
Some candidates identified a valid edaphic factor for ash (soil pH, with acidity included in the table) but few candidates demonstrated an understanding that the disappearance of ash pollen from the profile suggests that soil pH must have changed over time.
A significant number of candidates did not attempt this question.

Question 4(b)(i) Defining net primary productivity.
Most candidates did not include subtraction of the respiration component in their definition (NPP = GPP – respiration).
A significant number of candidates did not attempt this question.

Question 4(b)(ii) Describing a technique used to measure precipitation.
Many candidates were unable to name an appropriate piece of equipment used to measure precipitation (such as a rain gauge or similar receptacle with a calibrated measuring scale) or omitted reference to a collection period.
Use of a bucket or jug and measurement of precipitation volume is not an appropriate method for several reasons, including that precipitation is expressed in millimetres and not volume.
A significant number of candidates did not attempt this question.

Question 5(a) Explaining why a selected Milankovitch cycle could lead to natural climate change.
Few candidates achieved 2 or 3 marks, and many achieved 0 marks.
Some candidates provided annotated diagrams or detailed descriptions, but the descriptions often did not match with selected cyclical variation or did not explain why the cycle could lead to natural climate change.

Question 6(d) Suggesting why obtaining a resource from a single country may not be sustainable.
Most candidates provided a response relating to transportation, which is not relevant since all resources would need to be transported whether from single or multiple countries. Similarly, responses relating to ‘finite resource’ were not appropriate; although the Democratic Republic of the Congo holds the majority of the world’s cobalt supply, it is also available from other countries.

Question 7(c)(i)(A)	Calculating an interim target for total emissions. Few candidates achieved 2 marks, and many achieved 0 marks. Where candidates misread the graph, partial marks were awarded for a valid follow-through calculation. Most candidates did not achieve the second mark due to either not subtracting their initial calculated value from the 1990 baseline value, or because no or incorrect units were included with the final calculated value. A significant number of candidates did not attempt this question.
Question 7(d)	Describing the link between greenhouse gas emissions and global warming. A notable number of candidates referred to a hole in the ozone layer as a contributory factor in global warming. This is incorrect; a hole in the ozone layer will in fact contribute to global cooling because more heat can escape into space via the hole.
Question 8(a)(i)	Stating two factors that drive the global ocean conveyor belt. While many candidates were able to state one factor, few could state two.
Question 8(a)(ii)	Explaining how deep ocean currents are initiated in polar regions. Most candidates achieved 0 marks or 1 mark, including a significant number not attempting the question. The most common reason for not achieving marks was not linking temperature and/or salinity to changes in density. A similar question was included in the 2022 question paper.
Questions 8(b)(i), (ii)	Describing what is meant by upwelling, and explaining why it supports complex marine food webs. Few candidates demonstrated an understanding of upwelling and its importance to marine food webs. A significant number of candidates did not attempt either part of this question, despite a similar question being included in the 2022 question paper.
Essays	Marker and teacher feedback judged the pairings to be of similar demand. Mean marks for 9A, 10A, and 10B are similar to mean marks achieved pre-2022. A few candidates did not attempt one or both essays. A poor standard of literacy and/or knowledge commensurate with Higher was especially noticeable in responses. Candidates frequently missed marks due to use of incomplete sentences, unannotated diagrams, and bullet point lists (without further discussion).

Question 9

More candidates selected option B (hydrological cycle) than option A (constructive plate boundary mechanisms), and achieved higher marks overall for option B.

Option A:
Some candidates showed poor understanding of oceanic constructive plate boundary mechanisms, sometimes providing coverage of both constructive and destructive plate boundary mechanisms.
Few candidates included adequate coverage of resulting seabed features and deposits.

Option B:
Although marks awarded for this option were higher overall than for option A, descriptions provided by candidates were often basic and not commensurate with Higher.

Question 10

An approximately equal number of candidates selected option A and option B.
Overall performance in option B was slightly better than option A.

Option A:
Some candidates showed limited understanding of the common roles and individual responsibilities of the five key environmental agencies in Scotland. Incorrect naming of the agencies was frequent.
Relevant information covered previously in paper 1 should have helped candidates in answering this question, such as integrated management of Scotland's seas, marine conservation designation, or environmental monitoring.
Reference to Scottish Natural Heritage (SNH) and Forestry Commission Scotland (FCS) was not accepted as these agency names changed in 2019 to NatureScot and Forestry and Land Scotland (FLS) (and Scottish Forestry (FS)) respectively.

Option B:
Most candidates provided valid descriptions of the processes shown in the population dynamics graph, but were often unable to apply correct terminology or explain why the processes were occurring.

Section 3: preparing candidates for future assessment

Question paper

Centres should ensure that candidates are provided with a copy of the mandatory content tables and glossary (from the Higher Environmental Science Course Specification). These will enable candidates to familiarise themselves with phrasing and terminology used at Higher; in addition, the section headings and sub-headings in the first column of the table are often included in question stems and extended-response questions.

Centres should encourage candidates to practise past paper questions, as these and the marking instructions demonstrate the expected level and depth of response required.

Candidates should be directed to annual course reports, to help identify areas where previous candidates have performed well or had difficulty and why this might be.

Candidates **must** be given the opportunity to take an active part in a wide range of practical work and fieldwork, to develop the necessary knowledge and skills. This will help candidates address questions based around practical or fieldwork contexts. While demonstration of experiments, videos, and computer simulations may be useful additional tools, they cannot replace active practical or fieldwork and do not develop the knowledge and skills associated with these.

The areas where gaps in candidate knowledge and understanding were especially noticeable include the following:

- Definitions
- Calculations, including rounding and inclusion of appropriate units
- Living environment:
  - sampling plants and animals (paired statement keys, validity)
  - measuring abiotic factors (precipitation, effects of abiotic factors on frequency and distribution of organisms eg soil pH and presence or absence of certain tree species)
  - primary productivity (net)
  - population dynamics (population growth models, population oscillations, effects of density-dependent and density-independent factors)
  - environmental assessment and monitoring (purpose, key environmental agencies, MPAs, legislation)
- Earth's resources:
  - mechanisms of plate boundaries (constructive)
  - oceanic circulation
  - natural climate change (Milankovitch cycles)
- Sustainability:
  - global challenges (food security)
  - waste management (life cycle analysis, waste hierarchy)

Teachers and lecturers should highlight these areas to candidates and encourage them to develop the appropriate knowledge and skills.

Teachers and lecturers are encouraged to incorporate the command words used in exam questions into teaching at an early stage, especially the difference between ‘describe’ and ‘explain’, and ‘conclude’ and ‘evaluate’. ‘Suggest’ is commonly used in Higher Environmental Science question papers, allowing candidates to apply their knowledge and understanding in familiar and unfamiliar contexts.

Integration of key areas from across the course is a key feature of Environmental Science question papers, and some candidates find this challenging. It is also important that the environmental, economic, and social impacts of human actions, and relationships between them, are considered. Candidates should be encouraged to explore the interconnections between topic areas and identify the benefits and challenges that might ensue, for example global demand for food versus food security versus environmental impacts of intensive agriculture.

Candidates should be encouraged to write as clearly and legibly as possible, and to write in full sentences. Use of bullet points should be discouraged unless fuller discussion of each point is also included.

Candidates should be encouraged to attempt calculations and graphing questions. Many of the calculations are not especially challenging, perhaps involving large values or simple number substitution, but the number of candidates not attempting them suggests some are reluctant to spend time on them. In addition, candidates should be encouraged to show working, especially for calculations with multiple stages and marks. Showing working can be beneficial for the candidate if their final answer is incorrect.

Where a unit is included in a question stem, there is no requirement for candidates to state it alongside their calculated result. However, at Higher, it is good practice to do this — but care should be taken to ensure the unit is expressed correctly, especially if it is a complex unit (such as Mt CO_2 equivalent, where the ‘equivalent’ component is frequently missed).

Appendix: general commentary on grade boundaries

SQA's main aim when setting grade boundaries is to be fair to candidates across all subjects and levels and maintain comparable standards across the years, even as arrangements evolve and change.

For most National Courses, SQA aims to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade A boundary)

It is very challenging to get the standard on target every year, in every subject at every level. Therefore, SQA holds a grade boundary meeting for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of SQA's Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. SQA can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from question papers in the same subject at the same level tend to be marginally different year on year. This is because the specific questions, and the mix of questions, are different and this has an impact on candidate performance.

This year, a package of support measures was developed to support learners and centres. This included modifications to course assessment, retained from the 2021–22 session. This support was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic while recognising a lessening of the impact of disruption to learning and teaching as a result of the pandemic. The revision support that was available for the 2021–22 session was not offered to learners in 2022–23.

In addition, SQA adopted a sensitive approach to grading for National 5, Higher and Advanced Higher courses, to help ensure fairness for candidates while maintaining

standards. This is in recognition of the fact that those preparing for and sitting exams continue to do so in different circumstances from those who sat exams in 2019 and 2022.

The key difference this year is that decisions about where the grade boundaries have been set have also been influenced, where necessary and where appropriate, by the unique circumstances in 2023 and the ongoing impact the disruption from the pandemic has had on learners. On a course-by-course basis, SQA has determined grade boundaries in a way that is fair to candidates, taking into account how the assessment (exams and coursework) has functioned and the impact of assessment modifications and the removal of revision support.

The grade boundaries used in 2023 relate to the specific experience of this year's cohort and should not be used by centres if these assessments are used in the future for exam preparation.

For full details of the approach please refer to the National Qualifications 2023 Awarding — Methodology Report.