



Course Report 2016

Subject	Environmental Science
Level	Higher

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future assessment. It is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

Section 1: Comments on the Assessment

Summary of the course assessment

The number of centres presenting was higher in the second year of this qualification. There is a very positive increase in both centres and candidate numbers, and it is hoped the upward trend will continue. The majority of candidates from schools were S6 students and most had no previous Environmental Science (or Managing Environmental Resources) attainment. Uptake by colleges also increased significantly.

The comments that follow are largely drawn from marker reports, statistics and discussions during the marking process.

Environmental Science is a multi-discipline course, and anecdotal evidence suggests that it is taught predominantly by biologists or geographers (co-delivered in some cases), with some chemists and physicists also delivering. This mix of disciplines is sometimes evident in the assessment responses, especially in the assignment topics, but also in some question paper responses, and resulted in some interesting discussions during marking and some additions to the marking instructions. It is to be hoped that alternative views on course content will be taken on board by those delivering the course and passed on to candidates.

Component 1: Question paper

The question paper consists of two sections and is structured in the same way as the specimen question paper (SQP) and exemplar question paper (EQP).

The restricted response section (questions 1–9) includes questions with marks ranging from 1 to 4 marks. The extended response section (questions 10 and 11) includes both structured and unstructured questions, allowing candidates to demonstrate depth of knowledge and understanding of the topics. This mix of short and extended response questions allows candidates to demonstrate the breadth and depth of their knowledge and understanding, sometimes applying these to new situations, rather than straight recall.

Marks for each response are assigned in line with the marking instructions, which are frequently added to during the marking process. Where there is dubiety over a candidate's response or an innovative response has been provided, these are discussed by the marking team and a collective decision is made whether to accept or reject the response. The marking instructions are therefore another useful teaching aid.

The question paper performed largely as intended by the writers, and some high quality responses were provided, reflecting both breadth and depth of knowledge. Feedback from the marking team and also from a good number of candidates suggests that it was a fair paper. The cross-unit integrated nature of the questions and use of candidate-friendly language were well received. The use of 'suggest' questions also met with approval as these allow candidates the opportunity to discuss their own experiences and/or knowledge. However, a couple of questions were clearly problematic for candidates:

- ◆ Question 4(a) on product obsolescence. While almost all candidates completed the table, many failed to justify their responses. Markers felt that this was likely to be due to a spacing issue and/or that 'justify your answers' should perhaps have been in bold text.
- ◆ Question 7(c)(ii) on environmental advantages of urban living. While most candidates knew about differences in waste collection strategies between urban vs rural environments, the majority were unable to discuss the advantage of urban living in relation to domestic energy. On reflection, the marking team felt that there had been an unfair assumption that all candidates would be familiar with urban living.

The grade boundary was reduced by two marks (one mark for each question) to take account of this.

Other questions that candidates found challenging were:

- ◆ Question 9(a) — it was apparent that there are differing interpretations of how to describe a trend across the various disciplines. All reasonable correct responses were accepted.
- ◆ Question 9(c) — the role of the Coriolis effect on atmospheric circulation. Very few candidates were able to discuss even the basics of this, with the majority either discussing the tri-cellular model for energy redistribution or not attempting the question at all. The Coriolis effect is included in two mandatory course key areas and therefore should have been covered in some detail, and consequently no mark adjustment was made for this question.
- ◆ A number of questions sought basic definitions of terms listed as mandatory content (eg biofuels, EIA and SEA, gross productivity) and these should therefore have been fairly straightforward Knowledge and Understanding questions. Consequently, no mark adjustments were made.

The majority of candidates opted to answer Question 10B (hydrogen economy), with very few tackling Question 10A (water use in brewing and papermaking). There was a fairly even split between questions 11A (sampling techniques) and 11B (impact of climate change). In contrast with 2015, where a significant number of candidates did not attempt or complete both extended response questions, it was heartening to see that almost all candidates this year made some attempt at the extended response section, and the majority completed both questions.

Component 2: Assignment

Marks for each response were assigned in line with the SQA's General Marking Principles and detailed marking instructions.

Marks for the assignment were much improved on last year.

Markers commented positively that a good number of centres appear to have allowed their candidates free choice in assignment topic, while others look to have provided a list of suggested topics or assignment packs. Only in a few cases did all candidates from any one

centre present assignments on a single topic; this is something that should be carefully considered by centres as there is an intention that candidates should have a degree of choice, and also that teachers should guide and support rather than instruct.

A report structure is provided in the marking instructions and candidate guide, but the final report does not need to adhere to this structure. However, almost all candidates did follow the recommended structure, and this made marking a much more straightforward process and was therefore to the benefit of the candidates.

No adjustments were made for the assignment at the grade boundary meeting.

Section 2: Comments on candidate performance

The mean mark for the question paper was lower than in 2015, but the mean mark for the assignment was considerably improved on last year.

Areas in which candidates performed well

Component 1: Question paper

A number of questions included unfamiliar contexts, requiring candidates to think laterally and apply their knowledge to new situations. In general, most candidates coped well with this.

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| Q1 (a)(ii) | This question was well done, with most candidates successfully describing the changes fully, including the % changes. |
| Q1 (a)(ii) and (iii) | Most candidates picked up on the disadvantage to the consumer of growing corn for biofuel, but then were not quite so sure about the advantage to the farmer. |
| Q2 (a) | A wide range of responses was accepted for this question. Candidates understood the possible impact of global warming on availability of fresh water from mountains, but were less clear about how it might affect coastal aquifers. |
| Q2 (c)(iii) | The majority of candidates were able to name a food production strategy for drought conditions. Responses were predominantly linked to targeted irrigation, and also cultivation of GM crops. |
| Question 3 | Candidates generally coped well with this question, which included some fairly challenging aspects of population dynamics, especially parts (c) and (d). |
| Question 4 | Despite some candidates not justifying their response in part (a), most candidates coped well with question 4. |

Q4 (b)(i)	Most candidates successfully described economic and environmental outcomes of obsolescence, but were often unsure about the social aspects (typically relates to employment).
Question 5	Parts (a) to (c)(i) were well done in the main. Part (c)(i) and (ii) proved more challenging.
Q7 (a)	A wide range of responses were accepted, providing the response related specifically to urban growth.
Q7 (d)	A 3-mark question. Candidates were free to discuss three individual impacts or to concentrate on fewer but in more depth, providing the response related to the impact of road transport on biodiversity (positive and/or negative). Candidates performed well with this question, with most focusing on negative impacts, though some saw road links as being positive for biodiversity.
Q10 B	The majority of candidates selected this option and were able to successfully cover the benefits and challenges of using hydrogen as a fuel. However, in many cases these were presented as bullet pointed statements with little or no discussion of each. Candidates should be made aware that they are unlikely to achieve high marks following this approach; if using bullet points to list eg benefits and challenges, they should then expand on the point to demonstrate the depth of their understanding as well as the breadth.

Component 2: Assignment

As already stated, marks were much improved on last year, but candidates performed better in some areas of the assignment than in others.

Areas where candidates scored highly were:

Aim(s) (1 mark): The majority of candidates stated a suitable aim. Of the remainder, the aim was either omitted or overly ambitious and therefore not met, or not appropriate to the report content.

Selecting information (2 marks): Most candidates selected relevant data or information from at least two sources.

Presenting: correct format (1 mark): Most candidates presented data in the correct format (graph, table, chart and/or diagram).

Title and structure (1 mark): Most candidates achieved the mark available for including an appropriate title and using a report structure.

Referencing (1 mark): Most candidates achieved the mark for including references to at least two sources.

Areas which candidates found demanding

Candidates continue to find calculations challenging, though it was good to see that most did attempt those in the question paper. These calculations were not considered by the writing team to be particularly demanding, but the mean marks do not reflect this. Graph production also continues to be an issue for some candidates.

Centres should ensure that plenty of opportunity is given for practising calculations (especially use of large values) and graph production, using the assignment marking instructions as a guide as these clearly lay out what is required in graph production for Higher Environmental Science.

It should be noted that some of the questions commented on below were intended to be demanding, and that some high quality responses were received. However, there was also evidence of major gaps in knowledge that centres should address.

Component 1: Question paper

- Q1 (a) A definition of a biofuel is provided in the Course and Unit Support Notes. Candidates should be able to state this or similar.
- Q1 (c) While most candidates were able to suggest a reason *against* the claim for biofuels being carbon-neutral they often struggled with a reason in support of the claim.
- Q1 (d) Responses typically included a named piece of legislation or policy, but the function of the example was often poorly covered. Candidates should be able to name and discuss current legislation and government policy relating to food production.
- Q2 (c) Use of *suggest* in this question allowed candidates free rein to consider whether (and why) fruit trees or vegetables should be prioritised for irrigation and some interesting and innovative responses were provided. However, most candidates struggled to make the link between food production and the need for sustainable water management in areas affected by drought.
- Q5 (c)(ii) Knowledge of the roles of both SEPA and SSSIs was generally very poor. Candidates should be familiar with the roles and responsibilities of the four stated statutory agencies (SEPA, SNH, FCS and MS) plus the key role of SSSIs, as these are important in the management of human influences on biodiversity in the UK and EU.
- Q6 (a)(ii) Explanations for why some aircraft climb rapidly to above 10 000 m tended to miss the environmental context eg it reduces fuel use (commercial advantage) therefore also reduces emissions of greenhouse gases (environmental advantage).
- Q6 (b) While most candidates were able to name a greenhouse gas, the majority failed to name a source of the gas and/or explain how the

named example contributed to the enhanced greenhouse effect. This may have stemmed from a lack of understanding of the meaning of *anthropogenic* and/or *enhanced* greenhouse effect.

Candidates frequently confuse global warming/climate change with ozone depletion (hole in the ozone layer), and centres should ensure that candidates know that these are two separate problems and that one is not the cause of the other.

- Q7 (e) The purpose of environmental assessment was generally known but most candidates were unable to describe the difference between an EIA and SEA. Candidates should be aware of basic definitions.
- Q8 (c) Productivity (both gross and net) is a key term in discussion of energy conversion, transfer and loss at Higher level. Candidates should be aware of the definitions and also familiar with gain/loss calculations.
- Q8 (d) The links between the positives and negatives of food availability/security, increasing affluence, intensive farming and sustainability of supply should be emphasised. A wide range of responses was accepted but most were fairly weak and few achieved both marks for this question.
- Question 9 Some candidates commented on there being no requirement for them to know about tidal ranges, phases of the moon, and the links between the two. However, most of this question involved problem solving, and the candidates were being asked to extract from information provided.
- Q9 (a)(ii) This should have been a straightforward calculation, requiring candidates to identify the lowest high tide and the highest low tide, and calculate the difference.
- Q9 (c) Worth 4 marks, this question was seeking basic discussion of the cause of the Coriolis effect and its differing impact on atmospheric circulation at the equator and poles. Some candidates erroneously discussed the impact of the Coriolis effect on *oceanic* circulation rather than *atmospheric*, but the majority provided discussion of the tri-cellular model. In general, knowledge of the Coriolis effect was very poor.
- Question 10 This was a structured extended response question, with the option of discussing either water use (in brewing and papermaking) or the use of hydrogen as a fuel. The majority competently covered use of hydrogen. Language and style used were good in the main but there was a tendency to use bullet points to list the benefits and challenges of hydrogen as a fuel and sometimes little accompanying discussion. Candidates should be made aware that while bullet points are acceptable for listing items or key points (breadth of knowledge); they

should then discuss the individual points to show the depth of their knowledge.

- 10A Very few candidates opted for this question, and it was then poorly done. Although the context of water footprinting may have been unfamiliar to candidates, information was provided in the question stem that should have acted as a trigger for discussion of water use in brewing and papermaking, a mandatory course key area. Credit was given for relevant and correct discussion of water input in timber cultivation, pulp production and processing, and effluent disposal.
- Question 11 This was a structured extended response question, with the option of discussing either sampling techniques or the impact of climate change on biodiversity. Slightly more candidates opted for Q11A than Q11B, and also performed better with Q11A. Again, the language and style used were good overall, with full responses and fewer tendencies to use bullet points than for Q10.

Component 2: Assignment

The overall improvement in assignment marks is obviously a very positive outcome, but there are still some areas where centres should focus attention.

Apply knowledge and understanding of environmental science (5 marks): Not all candidates explained the topic and its underpinning environmental science in sufficient detail to be awarded full marks. Centres should therefore emphasise the importance of this component when advising their candidates.

Presenting: headings, labels and units (1 mark): Not all candidates achieved this mark, with some making basic errors when presenting their data. A common error was incorrect use of abbreviated chemical formulae eg CO^2 or CO_2 in place of CO_2 .

Processing (1 mark): The mark was frequently lost through incorrect plotting of points on graphs, but the main cause was failure to include both major and minor gridlines when using a graphing package (a stated requirement in the detailed marking instructions). Few candidates included calculations but, where these are used, a clearly worked example should be included, and results can thereafter be included in a table as necessary.

Cross-referencing (1 mark): Each piece of data/information must have an accompanying reference, preferably cross-referenced (with a citation or other indicator) with a source listed at the end of the report. Some candidates missed the mark because there was no cross-referencing to a source in the reference list.

Analysis (2 marks): This element requires candidates to interpret the data/information/results (ie what do the findings show) and was not particularly well done.

Conclusion (1 mark): Candidates frequently confused the evaluation and conclusion, so should be made aware of the difference between the two and also that the conclusion should relate back to the aim(s): did the findings support the aim and why this was so?

Evaluation (3 marks): The evaluation section is where candidates should consider what might have impacted on the findings, either positively or negatively. The majority commented on the validity and/or reliability of data/information, some repeating much the same comments for three sources and consequently were not awarded full marks — and some were not clear about the difference between validity and reliability. It is suggested that candidates should practice wider evaluation, including robustness of findings and evaluation of experimental or research procedure.

Section 3: Advice for the preparation of future candidates

Component 1: Question paper

Centres should now have access to two specimen papers and two live exam papers, plus exemplars and commentaries prepared for the Understanding Standards event. Higher Managing Environmental Resources, Biology and Geography past papers may also be of value for exam preparation. Candidates may find it useful to have access to the three-column table showing mandatory course content, which can be found in the Course and Unit Support Notes.

A range of different question types are included in the restricted response section of the question paper, some asking for 1-mark responses and others for 3-4 mark responses. While some are seeking only short responses (command word: state, name, identify, describe), others are inviting candidates to demonstrate the depth of their knowledge and understanding and occasionally to apply these to new situations (command word: explain, suggest, discuss). While the command word used and stated mark are indicators of the depth of response required, candidates should be encouraged to provide full responses where possible. They should also be dissuaded from using bullet points unless the individual points are then to be discussed in more depth.

Candidates should be encouraged to practise calculations (especially with large values) and graph preparation. Centres could provide candidates with the marking instructions for the assignment, which include in-depth guidance on what is expected at this level for graph preparation.

Candidates should be encouraged to practise time-management to ensure they have sufficient time to complete the paper, especially the extended response questions. Evidence of planning for extended response questions could be included on the question paper as this can be used as evidence should the candidate run out of time.

Component 2: Assignment

It is recommended that candidates be given opportunity for practising report writing prior to starting the assignment so that, read in conjunction with the candidate guide and marking instructions, they are fully aware of the required content.

Candidates should include a clear and achievable aim, and then keep referring back to it while writing up the report to ensure relevance of discussion. The underlying environmental science is one of the most important elements of the assignment (worth 20% of the marks) and therefore is worthy of considerable attention, though the emphasis should be on quality rather than quantity of discussion.

Improved marks and much broader range of topics presented suggests a growing confidence in assignment preparation both by teachers and candidates. It was encouraging to see that some centres were obviously allowing candidates free choice in their assignment topics, albeit that some were perhaps overly ambitious in their scope.

One Understanding Standards event was held for this subject during 2015–16, with a good turnout from centres already delivering Higher Environmental Science, or considering delivering it. Feedback suggests that those who attended found the event to be very useful, particularly for discussion of the assignment component, as there was still considerable confusion concerning how it should be conducted.

Assignment and question paper exemplars, with accompanying commentaries, were published on the SQA website, and it is hoped teachers unable to attend the Understanding Standards event also found these to be a useful aid.

Grade Boundary and Statistical information:

Statistical information: update on Courses

Number of resulted entries in 2015	83
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Number of resulted entries in 2016	392
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Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	8.2%	8.2%	32	82
B	19.6%	27.8%	77	70
C	32.9%	60.7%	129	58
D	9.9%	70.7%	39	52
No award	29.3%	-	115	0

General commentary on grade boundaries

- ◆ While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary), it is very challenging to get the standard on target every year, in every subject at every level.
- ◆ Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.
- ◆ The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- ◆ The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- ◆ Where standards are comparable to previous years, similar grade boundaries are maintained.
- ◆ An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.
- ◆ SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.