Course Report 2017

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, and number of candidates presented, continues to increase year-on-year, and it is very much hoped that this will continue as more centres become aware of this course. Statistics reveal that around 89% of candidates entered with no previous experience of environmental science, with the majority picking up the course at S6 level.

Attendees at SQA-led events, plus anecdotal evidence, reveals that this multi-discipline course is being taught by practitioners from a wide range of backgrounds; predominantly biologists and geographers, but also chemists and physicists. Once again, the mix of skills and specialist knowledge from these disciplines is occasionally evident in candidate responses, especially assignment topics, but also in the question paper. This provides for some interesting discussion and knowledge transfer at the central marking events, with marking instructions updated to reflect various approaches used in different subjects, which also provides a useful teaching aid for teachers/lecturers.

Performance in the question paper was on a par with 2016.There was a significant improvement in the assignment, with a 2-mark increase in average marks since 2016. The impact of so many candidates entering without prior knowledge of environmental science is unknown since it might be that many will have a background in another science.

Overall, candidates should be commended for their efforts. Results show that they coped well with their assignments, with some very interesting topics presented and high marks awarded. Candidates frequently find exams challenging, but in the main they coped well with this year's question paper, demonstrating both breadth and depth of knowledge.

Component 1: question paper

The question paper sampled the entire course and was structured in the same way as the specimen question paper. It consisted of an 80-mark restricted response section, followed by a 20-mark extended response section. There was an approximate 75 knowledge and understanding / 25 problem solving split, with candidates required to demonstrate the breadth and depth of their knowledge and understanding, including applying this to new situations. Approximately 30% of the questions were intended to be challenging, aimed at the A-grade candidates.

The restricted response section included questions with marks ranging from 1 to 3 marks, some with a cross-unit approach. The extended response section included both structured and unstructured questions, with candidates offered a choice from pairs of topics.

The question paper performed as intended, and feedback from teachers has been positive. In addition to accurate recall, candidates frequently demonstrated good lateral thinking skills, especially in the 'suggest' questions, where they could bring in their own experiences and knowledge. However, marker feedback included comments about poor literacy skills (extremely poor handwriting in some cases), and also that perhaps some candidates should

not have been presented at this level. The most obvious issues related to understanding of command words, eg the difference between 'explain' and 'describe', and a continuing issue with being able to provide basic definitions.

Component 2: assignment

The majority of this year's assignments were investigative, but some centres had also undertaken experimental and fieldwork activities, with all candidates at these centres presenting the same topic. For others, the investigation topics often reflected the background of the delivering teacher, but the wide range of topics overall suggests that the majority of candidates were allowed free choice.

Candidates now tend to follow the recommended SQA report structure, with clear headings, which makes marking more straightforward.

Section 2: Comments on candidate performance

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.

Candidates performed particularly well in the following questions.

Q1 (d)	Impact of increased acid rain on barnacles.
Q2 (a) (iv)	Environmental problems associated with extraction of mineral deposits.
Q3 (a)	Social and economic impacts of waste management.
Q3 (b)	Environmental impacts of development.
Q3 (c)	Evaluation of sites for a waste management facility.
Q3 (d)	Controversial nature of incineration.
Q4 (a) (ii)	Use of clay for cat litter.
Q5 (a)	Longer-term effects on a food web when a species is reduced. Some of the marking team commented on the unusual 'circuit board' layout of the food web, but candidates seem to have coped well with it.

Q6 (d) (i) Ratio calculation.

Q6 (d) (ii) Completing a graph. The *x*-axis markers were intended to direct candidates towards drawing a bar graph; this could then have been easily compared with the bar graph provided in part (iii). It is recognised that *year* can be regarded as both a qualitative and quantitative variable. The marking team felt that it would be unfair to penalise those candidates who had opted to display the data in a line graph. Candidates were awarded the marks providing the approach for plotting against the *x*-axis was consistent for each year and correct across the graph. This being the case, most candidates produced good quality graphs.

Q6 (d) (iii) Describing the trends shown in two graphs. The intention had been for candidates to describe **and** link the trends, but responses suggest this was not made sufficiently explicit in the question. Responses correctly describing each graph though not necessarily linking the trends were accepted. This resulted in a good set of responses.

Q7 (c) (ii) Reducing carbon emissions.

Q7 (d) Relationship between human population growth and species extinctions.

Q8 (c) (i) Locating a wave power station.

Q8 (c) (ii) Advantages of wave power over conventional energy sources.

Extended response questions

Language and style were good in the main, but it was noticeable that an increasing number of candidates are using bullet-point lists in their responses. Candidates should be made aware that while bullet points are acceptable for listing items or key points (showing breadth of knowledge), they should then expand each point in the list to demonstrate depth of knowledge. Where only a list was provided, a maximum of half marks was awarded. Similarly, a maximum of half marks was awarded where a suitable and appropriately labelled diagram was included without any discussion.

Statistics show that all candidates attempted both Q9 and Q10, suggesting that time management skills continue to improve. However, marks awarded for Q9 were significantly higher than those for Q10; whether this is related to structured vs unstructured, or content matter, or Q10 being the final question in the paper is debatable.

Around two-thirds of candidates opted for Q9A, but both questions performed well. Appropriately labelled diagrams were more frequent for Q9 B.

Q9 A	Hydrological cycle. The majority of candidates were able to discuss water movement and storage in considerable depth, using complex terminology in many cases.
Q9 B	Soil profiles. Diagrams were typically accompanied by discussion of the main distinguishing horizon features. Some candidates provided in-depth responses with use of complex terminology, but it was also evident that some candidates were not familiar with the two soil types.

Component 2: assignment

Aim	Almost all candidates were awarded the mark for the aim. In contrast with previous years, aims were typically very clearly stated.
Underlying science	A high percentage of candidates achieved more than half marks, with some achieving full marks. A holistic approach is used when marking this section, and candidates demonstrated a good understanding of their chosen topic and at a depth appropriate to Higher level.
Select information	Most candidates were able to select two pieces of data/information that were relevant to their investigation and which allowed for a conclusion to be drawn.
Process and present	The majority of candidates used appropriate presentation formats, and with correct headings, labels, units and/or scales. Sources were also cross-referenced appropriately.
Presentation	Almost all candidates were awarded the mark for title & structure, and a very high proportion for referencing their sources – though at Higher level, candidates should get into the habit of referencing all sources used.

Areas which candidates found demanding

Component 1: question paper

Q1 (c) (i) and (ii)	Quantitative and qualitative sampling techniques. Poor depth of knowledge, especially in relation to estimating frequency and distribution **along** a shoreline. Many candidates correctly described use of a quadrat (equipment, not a method) but in the context of random sampling rather than a transect study (method). Very few mentioned the need to repeat the transect at intervals along the shoreline in order to gauge frequency and distribution.
Q2 (a) (iii)	Mineral ore formation at subduction zones.

Q2 (b) (i) and (ii) Initiatives for the protection, promotion and sustainable use of the geosphere.

Q4 (a) (i) Formation of clay. Responses relating to formation of clay either as a mineral or as a deposit were accepted, but the question was poorly answered in general.

Q4 (a) (iii) Uses of fuller's earth. The majority of candidates seem to have been unaware of this type of clay and its uses. It was recognised that this content, while valid, was from the periphery of the course content and as such an adjustment was made to the grade boundary for all candidates.

Q4 (b) (i) Biomes associated with high pressure. Candidates often did not appear to understand the term *biome*, while others named a biome but often not one associated with high pressure.

Atmospheric conditions associated with the formation of the high pressure biomes was poorly done.

Where candidates named an incorrect biome (part A) but their description of associated atmospheric conditions (part B) was correct for their named biome, marks were awarded for appropriate part B description.

Q4 (b) (ii) Natural factor influencing climate variability. Many candidates were unable to correctly name a natural factor that influences climate variability (part A), while discussion of influence of the factor on climate variability (part B) incorrectly focused mostly on short term variation in weather. Also, unfamiliarity with term *variability* was apparent.

Where part A was incorrect but part B was correct for the named factor, marks were awarded for part B only.

Q4 (b) (iii) Positive impacts of the Eden Project. Impacts on the local environment (part A) was well done, but impacts on the global environment (part B) less so. However, part B was intended to be a demanding question.

Q5 (b) (i) Negative factors associated with aquaculture. Candidates often confused the aquaculture net cages with trawler nets and described impacts associated with fishing.

Q7 (a) Definition of *carrying capacity*. Candidates may be less familiar with this application to human population but the ecological context remains the same.

Q7 (c) (i)	Relationship between two trends. Candidates tended to describe rather than explain the relationship. Again, an issue with understanding of command words.
Q8 (a) (i)	Definition of *ocean gyre*.
Q8 (a) (ii)	While candidates appear now to be more familiar with the Coriolis effect, the majority failed to link this with the ocean gyres.
Q8 (b) (ii)	Calculation of the mean mass of a plastic pellet. The calculation was quite well done but candidates frequently lost the mark for not including the unit, or not using the correct unit. Where the unit is not stated in the question, candidates are required to include it.
Q8 (b) (iii)	*Reliability* and *validity*. Candidates are more familiar with being asked how these could be improved, and found it more demanding in this context of evaluating evidence provided.

Approximately two-thirds of candidates opted for Q10 A. Average marks for Q10 A and Q10 B were comparable, but overall performance in Q10 was not as high scoring as Q9.

Q10 A	Persistent organic pollutants. Despite inclusion of pesticides in the question stem, candidates continue to show poor understanding of bioaccumulation and biomagnification associated with these. Many candidates also failed to link these to impacts on biodiversity.
Q10 B	Abiotic factors affecting aquatic organisms. A significant number of candidates provided responses relating to biotic factors rather than abiotic. Responses in general tended to be low level, again often failing to link the abiotic factors with influences on biodiversity.

Component 2: assignment

Processing	Where graphing packages were used, many candidates failed to include both major and minor gridlines. A significant number of candidates included pie charts in their assignments, some drawn by hand and others using a graphing package. For both methods, marks were frequently lost for failing to include appropriate labels and/or units.
Analysing	Candidates continue to struggle with interpreting their findings to identify trends and relationships.
Concluding	As in previous years, candidates frequently confused *conclude* with *evaluate*. The conclusion must relate back to the aims and be supported by data/information in the report.

Evaluating	Most candidates focused on the reliability, validity and/or robustness of their sources, but many clearly did not understand the meanings of these terms. Very few who undertook practical work for the assignment commented on experimental procedure.
Presenting	Ideally, references should be included in an appropriate place within the body of the report, but they must also be listed at the end of the report. This should be before any clearly labelled appendices. Candidates undertaking experiments or fieldwork activities frequently failed to reference the source of their raw data. For practical activities such as these, the title of the activity and its aim should be included in the reference list at the end of the report.

Section 3: Advice for the preparation of future candidates

Component 1: question paper

Centres now have access to three live question papers and an exemplar question paper. In addition, exemplars of candidate papers with accompanying commentaries are available on the Understanding Standards website.

Candidates have commented that they find it useful to have access to the three-column table showing mandatory course content (found in the Course and Unit Support Notes). This is particularly the case for extended response questions as the question stems often include terminology or phrases included in the key areas column.

To reduce loss of valuable marks through misinterpretation of command words (especially *describe* vs *explain* and *conclude* vs *evaluate*), centres are encouraged to incorporate definitions and use of command words into teaching at an early stage. Command words causing particular problems for candidates include:

- Describe – provide a detailed statement. More than an outline or list.
- Explain – a more detailed coverage of the topic that relates cause and effect and/or make relationships between things clear.
- Conclude – arrive at a judgement or opinion through reasoning, based on available evidence, ie objective judgement.
- Evaluate – make a judgement based on criteria; or determine the value of something, ie subjective judgement.

Use of *suggest* is common, allowing candidates to demonstrate lateral thinking and/or bring in their own experiences or knowledge.

Definitions of key area terms continue to be an issue. As questions on definitions are common, it may be useful for candidates to build a glossary of terms across the year.

Calculations were much improved this year, but candidates should continue to practise these, especially calculations involving large values. They should also be encouraged to include units in their responses, even if the unit is included in the question stem.

Graph preparation was also much improved, but candidates should look for clues about the type of graph expected where no explicit guidance is provided. Also, they should be more aware of the additional requirement for inclusion of major and minor gridlines where a graphing package is used.

Use of bullet-pointed lists in extended response questions is increasing. As the command word typically used is *discuss*, providing lists is not something we would encourage in Higher Environmental Science unless expansion of each point is then provided. Candidates run the risk of losing at least half the available marks if only lists are provided. Diagrams are always useful but, again, should have accompanying commentary.

Time management also appears to be improving, with almost all candidates attempting both extended response questions. However, the unstructured extended responses are often very brief or obviously rushed; whether this is due to the content or to running out of time is debatable. Candidates should be encouraged to plan their extended responses (and include these notes), perhaps at the start of the exam, as planning notes can be used as evidence should the candidate run out of time. It would also be useful to candidates to be practised in writing unstructured extended responses.

Component 2: assignment

Quality of assignment reports continues to improve year-on-year as candidates become more familiar with the process. However, while it is evident that candidates from some centres are well drilled in preparing assignment reports, there is still room for improvement overall. Centres are encouraged to provide candidates with copies of the candidate guide and the marking instructions, and to provide focused classroom guidance of what is expected.

The underlying environmental science is an integral part of the assignment, attracting 20% of available marks, and is marked holistically. The emphasis should be on quality rather than quantity, and candidates should be encouraged to develop the skill of summarising key points from published text, and then linking key points from different sources, to better demonstrate the depth of their knowledge and understanding. The sources used, and ensuing discussion of their content, should be at a level commensurate with Higher as marks are not awarded for general information.

Where a centre undertakes a class/group experimental or fieldwork activity and data from this activity is used by all candidates in the class/group, personalisation of choice of activity may appear to be limited. However, collaborative experimental or fieldwork activities should not result in all candidates producing very similar reports; how the experimental or fieldwork data are further used can be personalised, for example through selection from a list of extended topics which the data could feed into.

Anecdotal evidence suggests that some centres routinely photocopy assignment reports before submission. However, centres are reminded that teachers should not read assignment reports before submission, nor provide feedback or allow re-drafting.

Whilst it was pleasing to see that the conditions of assessment for coursework were adhered to in the majority of centres, there were a small number of examples where this may not have been the case. Following feedback from teachers, we have strengthened the conditions of assessment criteria for National 5 subjects and will do so for Higher and Advanced Higher. The criteria are published clearly on our website and in course materials and must be adhered to. SQA takes very seriously its obligation to ensure fairness and equity for all candidates in all qualifications through consistent application of assessment conditions and investigates all cases alerted to us where conditions may not have been met.

Grade Boundary and Statistical information:

Statistical information: update on Courses

Number of resulted entries in 2016	392

Number of resulted entries in 2017	454

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	11.7%	11.7%	53	83
B	17.6%	29.3%	80	71
C	27.5%	56.8%	125	59
D	11.0%	67.8%	50	53
No award	32.2%	-	146	-

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.