Course Report 2017

Subject	Physics
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

Component 1 — question paper

The question paper consists of a 20-mark multiple choice section and a 110-mark written section. The mark for the written section is then scaled to a mark out of 80 and is added to the multiple choice mark to give a total out of 100. This mark is then added to the assignment mark, giving a total out of 120.

The question paper contains questions sampling the entire course. The question paper also assesses a range of knowledge and skills across the entire course.

In the multiple choice section of the paper, question 9 did not perform as intended. The grade boundaries at all levels were adjusted to take this into account.

In the written section of the paper, question 4 and question 12(c) were more demanding than intended. The grade boundaries were adjusted to take this into account.

Component 2 — assignment

The assignment is carried out in centres under supervised conditions. Candidates are required to produce a report that is assessed by markers. 20 marks out of a total of 120 are available for the assignment.

This part of the assessment performed mainly in line with expectations. There was an improvement in candidate performance over the previous year. There was a minor change to the marking of the assignment, as published in 2016. Candidates must process and present their experimental data. Therefore the processing of experimental data by candidates was the only processing considered in section 4 of the marking instructions. There were very few candidates who had not processed and presented their own experimental data.

It is clear that many centres have been using the material from the Understanding Standards events website. Centres should, however, exercise care with these materials as candidates should not copy any of the material.

Section 2: Comments on candidate performance

Areas in which candidates performed well

Component 1 — question paper

Candidates once again did well in sections of the question paper that require them to carry out calculations. There was also an improvement in the number of candidates who showed an understanding of orders of magnitude. Most candidates coped well when using an

equation that they had not seen before, and most could accurately plot a graph from data provided.

In question 13 of the multiple choice section, many candidates coped well with the problem-solving involved in this question.

In the written section candidates coped well calculating the redshift (question 5(b)(i)), calculating the mean lifetime of a sigma particle at relativistic speed (question 7(d)) and calculating the energy released from a nuclear fusion reaction (question 9(b)(ii)).

Component 2 — assignment

There is evidence that candidates who follow the 'instructions for candidates' were able to access the majority of the marks available for the assignment.

Areas which candidates found demanding

Component 1 — question paper

Questions testing recall of knowledge tended to be poorly done by candidates.

In question 9 of the multiple-choice	Many candidates were able to deduce that the maximum kinetic energy of a photoelectron would increase when the frequency of the incident radiation was increased. Very few were able to deduce that if the irradiance was unchanged and the photon energy was increased, there would be fewer photons and therefore fewer photoelectrons.
In question 2(a)(ii):	Many candidates failed to provide the correct definition of an inelastic collision. Many candidates failed to indicate that **kinetic** energy had **decreased** during the interaction.
In question 2(b)(ii):	Many candidates could not carry out the correct treatment of the uncertainties. Candidates appeared to be unaware that they should use the largest percentage uncertainty in the measurements to determine the overall uncertainty.
In question 8:	Many candidates could not properly describe the effect of magnetic fields on charged particles. Many candidates did not appear to have an understanding of the basic operation of particle accelerators, with both the acceleration and the deflection of particles being poorly answered.
In question 9(a):	Many candidates could not state that fusion was when two **nuclei** combine to form a larger **nucleus**.
In question 10(b)(i):	Many candidates used the values supplied for sin θ as if the data was values for θ.

In question 13(a):	Many candidates did not answer the question that was asked. The initial current was required but many candidates did not calculate this value. Candidates should be encouraged to read the questions carefully.
In question 13(b):	Many candidates did not identify that the **initial** current had increased despite the first part of the question asking about the initial current.
In question 14(a):	Many candidates could not identify the photovoltaic effect.
In question 15(b):	Many candidates failed to take into account the $\times 10^{-3}$ in the table heading, despite having included this in their graphs.

Component 2 — assignment

There were a number of examples of topics that were clearly beyond the candidates' capabilities eg rotational motion, Stoke's Law. Candidates should be encouraged to choose investigations with an appropriate level of demand, which includes physics at Higher level.

There were examples of candidates choosing scales that they found difficult to work with, eg each scale division was 0·47. Candidates should be encouraged to choose appropriate scales for graphs, which increase in increments that are easier to use.

Candidates are still having difficulty carrying out a full treatment of uncertainties from their experimental data. Centres should ensure that candidates understand that they must provide reading uncertainties for all of their experimental measurements and that they should be calculating random uncertainties for repeated measurements, showing a sample calculation.

In the analysis section, candidates should interrogate the data, especially their experimental data. This could be done through further calculations.

In the evaluation section, candidates are often not supplying a justification for their evaluation. For example, candidates should make it clear that they have considered why a source is reliable, or why a suggested experimental change would produce an improvement in their data.

Section 3: Advice for the preparation of future candidates

Component 1 — question paper

Centres should ensure that candidates can calculate the overall percentage uncertainty in the result of an experiment.

Centres should ensure that candidates know and understand the basic physics definitions required for the Higher course.

Centres should ensure that candidates have an understanding of the basic operation of particle accelerators, including the effects of magnetic fields on charged particles.

Centres should encourage candidates to read the questions, and the data given in the questions, carefully.

Centres should ensure that candidates are aware that they should start a show question by stating an appropriate relationship, showing the substitution and stating the required answer.

Candidates should be encouraged to be careful and consistent when applying a sign convention during calculations, eg in momentum calculations.

Candidates should be encouraged to use technical physics terms when answering questions.

Centres should ensure that candidates have experience of manipulating experimental data.

Centres should ensure that candidates understand the difference between experimental improvements that would improve reliability, and improvements that would improve precision.

Candidates should be made aware that the gradient of a line should be calculated using values from the line and not data points provided, which may not be on the line of best fit.

Component 2 — assignment

Centres should ensure that candidates are fully prepared before beginning the assignment.

Candidates should be encouraged to choose topics that are appropriate to the level, and that have practical work that produces sufficient data, and underlying physics commensurate with Higher level.

Centres are reminded that the practical work for the assignment must be carried out individually or in small groups.

Centres should ensure that candidates have access to the ‘instructions for candidates’ during the communication phase of the assignment.

Candidates should be encouraged to write an aim that is investigable. The experimental data and the secondary source, which could be a second experiment, must relate to the aim so that candidates can draw a valid conclusion.

Candidates should ensure that their data is sufficient to draw a conclusion that relates to the aim.

Centres should ensure candidates have a full understanding of uncertainties before they attempt their assignments.

Candidates should also be encouraged to include a justification for each of their evaluative comments.

When drawing graphs, candidates should be encouraged to clearly mark the position of their data points. If using Excel or other graphing packages, candidates need to ensure that they include both minor and major gridlines, the data points are not too large, and the graph is of an appropriate size.

When giving book references candidates should include author, title, page number(s), and either edition number, or ISBN.

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	9131

Number of resulted entries in 2017	8955

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	28.1%	28.1%	2520	82
B	26.0%	54.2%	2331	69
C	21.7%	75.9%	1943	57
D	8.1%	84.0%	727	51
No award	16.0%	-	1434	-

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.