Course Report 2016

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

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 paper also assesses a range of knowledge and skills across the entire course.

The question paper performed almost exactly in line with expectations.

Candidates appear to have coped particularly well with aspects of the question paper that focus on calculations. Candidates appear to have had more difficulty with areas that require them to state definitions or give reasoned explanations, or where they are required to analyse situations.

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.

The assignment section of the assessment performed mainly in line with expectations. There was an improvement in candidate performance over the previous year. It is clear that many centres have been using the material from the Understanding Standards events and website. Centres should, however, exercise care with these materials as candidates should not copy any of the material.

A small number of candidates' reports were lacking in that they consisted of little more than an Outcome 1 report with some background physics attached. Centres are reminded that the assignment is a more in-depth piece of work than an Outcome 1 experiment, and that candidates should be using the experimental data from the Researching Physics Unit in their assignment report.

Some candidates had taken the approach of carrying out two related experiments to generate experimental data, for example varying the number of blades and then the pitch of the blades to investigate optimum conditions for the operation of a wind turbine. Using two of their own experimental sources is permissible at Higher level, and can help produce very good assignment reports.

There were few very high or very low marks in this part of the assessment. Candidates who appear to have followed the advice in the candidate's guide managed to access the majority of marks available.

Section 2: Comments on candidate performance

Areas in which candidates performed well

Component 1: Question paper

In the objective section of the paper candidates were particularly good at answering questions 2 (velocity time graphs), 18 (potential divider) and 20 (charge on a capacitor).

In section 2 candidates scored highly in question 1 (a) (components of vectors), 2 (c) (i) (calculating potential energy) and question 10 (calculating refractive index).

Component 2: Assignment

Candidates scored most highly in the sections of the assignment that required them to give the aim of the assignment and in the selection of data that was relevant and sufficient. Most candidates are now providing reports with a correct structure and correct references.

Areas which candidates found demanding

Component 1: Question paper

Many candidates could not answer the questions asking them about definitions. Questions 3 (a), 3 (c), 8 (a) and 9 (a) all required candidates to either repeat a definition or use a definition. These questions were all poorly attempted.

In question 1 (d) many candidates could draw a graph that showed the final displacement would be less, but very few could identify that the line on the graph would be a curve and not a straight line.

In question 4 (b)(i) most candidates could not provide a suitable justification for why the speed of light did not change.

In question 4 (b)(iii) many candidates did not realise that they needed to define a frame of reference in order to comment on the statement.

In question 5 (a)(iii) most candidates could not explain why the model was a good simulation of the expansion of the universe. Candidates were confusing terms such as star and galaxies, and were not stating that distant galaxies are moving away from each other. Candidates were also confusing acceleration with recessional velocity in their answers.

In question 7 (c) many candidates could not draw the diagram to the required degree of precision. The standard applied to the drawing of the diagram was the same as that in the Unit Assessment Support Pack.

In question 8 (c) many candidates could not explain the containment issues in a fusion reactor.

In question 9 (d) many candidates could not explain that changing the separation of the gaps would have no effect on the path difference.

In question 10 (c) most candidates could not identify that the ray of light would emerge parallel to the original ray of light.

In question 12 (b) many candidates were answering the question solely in terms of recombination of holes and electrons with no reference to band theory. As the question specifically asked candidates to use band theory, these candidates could not access these marks.

Component 2: Assignment

Many candidates found it difficult to gain the mark for the uncertainties. In some cases this was due to candidates not including all the reading uncertainties. For example, where a metre stick was used to measure a distance many candidates did not give the reading uncertainty in the distance.

In the analysis section few candidates are making any attempt to interpret their data. For example, few candidates are calculating constants (if appropriate) or attempting to relate their uncertainties to their findings.

In the evaluation section some candidates were not giving supporting evaluative statements when they identified issues with either a practical activity or an internet source. It should also be noted that candidates cannot evaluate an experimental procedure unless they have described the experimental procedure.

Section 3: Advice for the preparation of future candidates

Component 1: Question paper

Centres should ensure that candidates have learned basic definitions, perhaps by rote learning, such as coherence and the law of conservation of linear momentum.

When candidates are attempting a ‘show’ question they should begin their answer with a relationship from the relationship sheet included with the exam. The final answer should be the exact value given in the question.

Centres should also encourage candidates to be more precise in their use of language. For example, candidates should be made aware that, when defining an inelastic collision, the kinetic energy is greater before the collision than after. It is not sufficient to say kinetic energy is not equal, or to say it is not conserved, as this would also be true for an explosion. Candidates should also be made aware that it is incorrect to use the term ‘energy’ when they should use the term ‘kinetic energy’.

Centres should ensure that candidates are aware that it is important to define a frame of reference when answering questions on the theory of relativity.

Centres should also encourage students to be more precise in their drawing of diagrams. In question 7 (c), for example, many students could not draw evenly-spaced parallel lines between the two plates drawn on the exam page.

Centre should ensure that candidates are familiar with band theory when describing semiconductors.

A small number of candidates are using an ellipsis in intermediate working to indicate that they have not set down all of the figures that they are using (eg 10·1234…). This should be strongly discouraged, as candidates are making transcription errors or incorrectly rounding numbers before the ellipsis. If candidates are not setting down all the figures they should use at least one more significant figure than should appear in their final answer.

Component 2: Assignment

Candidates should be encouraged to carry out an investigation that has an appropriate level of demand for Higher Physics. Some centres are submitting assignments that are either at National 5 or Advanced Higher level, which is disadvantaging their candidates. The choice of some topic areas (eg angular motion) made accessing marks in the underlying physics section, in terms of applying knowledge and understanding at a suitable level, more difficult for some candidates.

Candidates should be given guidance on the use and calculation of uncertainties. When calculating a random uncertainty, a sample calculation, including the formula, must be shown. All uncertainties must include units where appropriate. They should also be given guidance on how to interpret their data in light of their uncertainties.

When analysing their data candidates should be encouraged to consider what information can be extracted from their findings. For example, the calculation of a constant (if appropriate), how uncertainties have influenced their processed data, a discussion of any systematic uncertainties in their processed data, etc. If the gradient of a line is calculated, this must be supported by an explanation of the significance of this value.

When carrying out the evaluation of their investigation, centres should make candidates aware that the three marks are for three distinct evaluative comments. For example, it is not sufficient to gain three marks to state that three internet sources are reliable because they are government websites. Each statement should be supported by appropriate justification.

Candidates should be made aware that the final item in their report (excluding any clearly labelled appendices) should be their references.

Candidates should be encouraged to differentiate between raw data and processed data. In their report candidates should present all of their raw data and then show how it has been processed.

If a candidate is to be awarded the mark for cross referencing, their practical work must either have a title and an aim in the body of their report, or be referenced via a title and aim in their reference section. Internet and text sources of raw data must also be clearly cross referenced.

Candidates should not be working from a prepared draft of their assignment.

Candidates should be using the data from the Researching Physics Unit as the basis of their assignment.

Candidates should be encouraged to follow the advice given in the candidate’s guide.

Centres are reminded that they should not provide a pro-forma for candidates to complete.

Centres are encouraged to consider the material available on the Understanding Standards website.

The assignment should be the work of the candidate and should not contain any material, except raw data, copied from any source.

Grade Boundary and Statistical information:

Statistical information: update on Courses

Number of resulted entries in 2015	3662

Number of resulted entries in 2016	9131

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	28.0%	28.0%	2553	84
B	26.2%	54.1%	2391	71
C	20.0%	74.2%	1829	59
D	8.2%	82.4%	749	53
No award	17.6%	-	1609	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.