Principal Assessor Report 2006

Assessment Panel:	**Physics**

Qualification area

Subject(s) and Level(s) Included in this report	**Physics Higher**

Comments on candidate performance

General comments

There has been an improvement in the performance of candidates in this year's examination compared to the last two years. Markers commented that there were fewer candidates who were very poorly prepared for the examination this year.

The introduction of the Data Booklet does not appear to have made much difference to the quality of the physics in candidates' answers. It may have helped to support some candidates but there were still many examples of equations being quoted wrongly and wrong equations being selected.

Questions requiring candidates to perform calculations were, as in previous years, generally answered to a very good standard. However, candidates performed much more poorly in questions requiring written descriptions and explanations.

Areas in which candidates performed well

In the multiple-choice section of the examination questions 6, 10, 13, 15 and 16 were particularly well done.

Question 21 – This was generally found to be a straightforward introduction to Section B of the examination and was done well by many candidates.

Question 23 – The Gas Laws calculation in part (a)(i) was very well done.
The answers to parts (b)(i) and (b)(ii) were calculated correctly by many candidates.
Part (c) was very well done – most candidates carrying out a correct calculation and recognising that this had then to be rounded up to a whole number of solar panels.

Question 25 – The potential divider calculation in part (a) was done correctly by many candidates.
In part (b)(iii) most candidates could carry out a calculation to find the energy stored in a capacitor.

Question 26 – The rms voltage calculation in part (a)(iii) was done well.

Question 27 – In part (a)(ii) most candidates were able to calculate the wavelength of the light and correctly deduce its colour.
In part (b), the calculation using the grating formula was very well done.

Question 28 – Parts (b) and (c) were answered well.

Question 29 – The calculation of energy released in the fission reaction in part (b)(iv) was very well done by the majority of candidates.

Areas which candidates found demanding

Question 21 – In part (a) a significant number of candidates could not state or derive an expression for the component of weight down a slope.

Question 22 – In part (a)(i) many candidates failed to "show" that the impulse was 0.35 Ns. This type of question should be answered using a relevant formula followed by correct substitutions and calculations.
Most candidates showed a poor understanding of impulse and in part (a)(iii) failed to take account of its vector nature in the calculation for the velocity of the ball after the bounce.
In part (b) many candidates did not follow the instructions to sketch the original force-time graph and clearly label the graphs. The majority did not realise that, with a harder ball, there would be both a larger maximum force and a shorter time of contact with the surface.

Question 23 – In part (b)(iii) explanations were poor. Many candidates stated that opening the valve would allow air out of the cool box, despite the information in the question saying that the internal pressure was less than atmospheric pressure.

Question 24 – In part (a) very few candidates gave the meaning of "*potential difference of 200 kV"* in terms of energy per coulomb.
In part (c)(i) a significant number of candidates were not able to substitute the value of the charge on a proton into the QV formula.
Very few candidates were able to give correct Physics in their attempts to explain what happens to the speed of the proton in part (d).

Question 25 – In part (b)(i) most explanations were poor and showed a lack of understanding of the process of charging a capacitor.
In part (b)(ii) many candidates failed to use the same value of potential difference as in part (a).
In part (b)(iv) candidates lost marks because they used an inconsistent value of voltage to calculate the maximum current and/or they failed to label the origin and/or their graph did not show the correct shape of decreasing current as the capacitor discharged.

Question 26 – In parts (a)(i) and (a)(ii) many candidates lost marks because they did not use the y-gain and timebase settings correctly along with the given traces.
A surprisingly high proportion of candidates could not select appropriate resistor values to give the required gain in part (b)(i).

Question 27 – In part (a)(i) very few candidates were able to give a correct description of the production of light in an LED. Many inappropriately used the term "*electron-hole pairs*" in their answers.
In part (a)(iii) many candidates correctly calculated the photon energy but followed this with a wrong conclusion about whether photoelectric emission occurs.

Question 28 – In part (a) very few candidates were able to state what is meant by the term *irradiance*.
In part (b) many candidates did not follow the instruction to use **all** the data to find the relationship.

Question 29 – In part (a) a significant number of candidates showed poor knowledge of Rutherford's experiment.
In part (b)(ii) few candidates could calculate correctly the mass number labelled as '***s***'.
In part (b)(iv) a significant minority of candidates inappropriately rounded the figures before calculating the loss in mass.

Throughout, many candidates showed a lack of understanding of the difference between quoting a final answer to an appropriate number of significant figures and quoting it to a number of decimal places.
Some candidates inappropriately rounded intermediate calculations as they worked towards their final answers.
In questions 24, 25 and 27 a number of candidates showed poor knowledge of the prefixes k, μ and n.

Advice to centres for preparation of future candidates

- Candidates should be encouraged to take more care in reading questions thoroughly and ensuring that the instructions in questions are followed precisely.

- Candidates should be aware that they may need to state or derive expressions which are not listed in the Data Booklet; for example, the component of weight of an object down a slope.

- Candidates should be encouraged to present their numerical analyses in a clear and structured way – markers need to be able to follow the logic in their answers.

- Most candidates require more practice at taking account of the vector nature of velocity and impulse in numerical calculations. A wrong sign used for these in a substitution is wrong physics.

- Where a question asks candidates to "show" that a certain value is correct, they should write down any relevant formula followed by correct substitutions and calculations in a clear and structured way.

- The number of marks allocated to each part of a question should be used by candidates as a guide to the extent of calculation or explanation required.

- There is a need for candidates to work on developing a deeper understanding of Physics at Higher level beyond having the ability to answer numerically based questions.

- Most candidates need more practice in writing descriptions and explanations. They need to be more careful in the precision of the language used in their descriptions and explanations. For example, saying that an increase in temperature causes "molecules to collide more" means very little. A more precise description would be "molecules collide with the container walls harder and more frequently".

- Candidates should be encouraged to study the content statements for the course. They must be able to give definitions of terms such as *potential difference*, *irradiance* etc.

- Candidates should label the origin and axes on sketch graphs.

- When a candidate makes two (or more) attempts for the same part of a question, they must score through the part(s) which they do not wish to be considered by the marker.

- Candidates should practise using all the prefixes listed in the content statements for the course.

- Candidates need to practise transferring knowledge from one Unit of the course to another; for example, the charge on a proton met in the Unit on Radiations and Matter may be used in a question based on the Unit on Electricity and Electronics.

- Many candidates need to develop a better understanding of how to quote "an appropriate number of significant figures" in final answers.

Statistical information: update on Courses

Number of resulted entries in 2005	8,951

Number of resulted entries in 2006	8,565

Statistical Information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum %	Number of candidates	Lowest mark
Maximum Mark - 90	-	-	-	-
A	29.0	29.0	2,481	65
B	23.8	52.7	2,037	53
C	20.6	73.4	1,766	42
D	8.5	81.9	730	36
No award	18.1	100.0	1,551	-

General commentary on passmarks and grade boundaries

- While SQA aims to set examinations and create mark schemes which will allow a competent candidate to score a minimum 50% of the available marks (notional passmark) and a very well-prepared, very competent candidate to score at least 70%, it is almost impossible to get the standard absolutely on target every year, in every subject and level
- Each year we therefore hold a passmark meeting for each subject at each level where we bring together all the information available (statistical and judgmental). 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 senior management team at SQA
- We adjust the passmark downwards if there is evidence that we have set a slightly more demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- We adjust the passmark upwards if there is evidence that we have set a slightly less demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- Where the standard appears to be very similar to previous years, we maintain similar grade boundaries
- 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 are different. This is also the case for exams set in centres. And just because SQA has altered a boundary in a particular year in say Higher Chemistry 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
- Our main aim is to be fair to candidates across all subjects and all levels and maintain standards across the years, even as arrangements evolve and change.