Principal Assessor Report 2007

Assessment Panel:	**Physics**
<u>Qualification area</u>	
Subject(s) and Level(s) Included in this report	**Physics Higher**

Comments on candidate performance

General comments

Markers commented that there were few candidates who were very poorly prepared for the examination this year.

Despite the Data Booklet being available to candidates during the examination, there were still numerous examples of equations being quoted wrongly and of inappropriate equations being used.

Questions requiring candidates to perform calculations were, as in previous years, generally answered well. However, candidates are still performing much more poorly in questions requiring written descriptions and explanations.

The quality of English used by candidates in their answers was similar to that of recent years.

Areas in which candidates performed well

In the multiple-choice section of the examination, questions 1, 2, 4, 5, and 8 were particularly well done.

Question 21 – In the main, this question was done well by many candidates and proved to be a relatively straightforward introduction to Section B of the examination. However, very few candidates received full marks for this question due to weaknesses in their treatment of vector quantities.

Question 22 – Part (c) was well done. Most candidates chose the appropriate equation of motion, substituted correctly and calculated the final velocity without mistake.

Question 23 – The gas laws calculation in part (a) was very well done. Most candidates were able to write down the correct gas law and use it correctly to find the new pressure.

Question 25 – Parts (a) and (b) were done well by more than half of the candidates. In part (a), these candidates were able to identify the value of the e.m.f. as the open circuit p.d. and then use this value in part (b) to calculate the current in the circuit and the value of the external resistance.

Question 26 – This question was answered very well by a large majority of candidates. A small number of candidates lost marks because they used wrong values of voltage in parts (b) and (c).

Question 27 – Part (a) was answered well. However, a small proportion of candidates did not substitute the given resistance values correctly into the Wheatstone bridge formula.

Question 29 – The calculations in parts (a) and (b) were answered well.

Question 31 – The calculation of energy released in the nuclear reaction in part (a) was very well done by the majority of candidates. There were, however, some candidates who inappropriately rounded values before finding the loss in mass.

Areas which candidates found demanding

In the multiple-choice section of the examination, questions 3, 13 and 16 were poorly done.

Question 21 – In part (a), many candidates who attempted to answer by scale diagram did not show arrows on vectors.
Many candidates did not realise that the answers to parts (a), (b) and (c) required a direction to be quoted as well as a magnitude in order for full marks to be gained.
Parts (b) and (c) revealed that a significant number of candidates did not appreciate the difference between velocity and speed. They attempted to calculate average velocity by dividing total distance by time and/or to calculate time from displacement divided by average speed.

Question 22 – In part (a), many candidates could not state or derive an expression for the component of weight down a slope.
In part (b), many candidates failed to "show" that the acceleration was 0.67 ms^{-2}. An essential part of an answer is that the candidate shows clearly how they arrived at the value of unbalanced force.
In part (d), a significant number of candidates thought that a smaller mass would result in a larger acceleration – their explanations showing that they had not considered the effects on the component of weight and on the resultant force.

Question 23 – In part (b), very few candidates realised that some gas would remain in the cylinder and so would not be available to fill balloons.
In part (c), candidates' explanations of the change in density when a gas expands into a greater volume showed very poor understanding. Many could quote the formula for calculating density, but could not use it correctly to explain what was happening in the given situation.

Question 24 – In part (c), most candidates attempted to answer by making reference to changing mass in the kinetic energy formula. They had not realised that the significant change was the halving of the value of charge in the $W = QV$ relationship.

Question 25 – In part (c), in their calculations to find the new terminal p.d., few candidates took into account the fact that a change in the circuit resistance also changes the current.

Question 27 – In part (b)(i), a significant number of candidates could not identify that the op-amp was being used in the differential mode.
In part (b)(iii), many candidates did not use the differential mode formula – that includes even some of those who had correctly answered 'differential' in part (b)(i).

Question 28 – In part (b)(iii), many candidates were unable to give the correct value of the sine of the angle (using the dimensions of the triangle in the diagram) and very few changed their percentage uncertainty into an absolute uncertainty in the final answer (as the question had instructed them to do).

Question 29 – In part (c), very few candidates linked the change in refraction with blue light having a higher frequency, thus showing a lack of familiarity with content statement 3.2.4.

Question 30 – In part (b)(ii), most candidates showed poor understanding of the photoelectric effect and were unable to give a correct explanation of how a decrease in irradiance affects the photoelectric current.

Question 31 – Part (b) was poorly attempted by a large number of candidates. Their answers displayed confusion in their understanding of the quantities; absorbed dose, absorbed dose rate, equivalent dose and equivalent dose rate.

In various parts of the paper, some candidates inappropriately rounded their answers to intermediate calculations as they worked towards their final answers.

In questions 26, 27, 29, 30 and 31, a number of candidates showed poor knowledge of the prefixes kilo, micro and nano.

Advice to centres for preparation of future candidates

- When drawing vector diagrams, candidates should use arrows to show the direction of each vector as well as the resultant.

- Candidates must remember to quote direction as well as magnitude when giving vector quantities as answers.

- Many candidates need further practice in differentiating between distance and displacement, speed and velocity.

- 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.

- Where a question asks candidates to "show" that a certain value is correct, they should write down any relevant formula(s) and follow this with correct substitutions and calculations in a clear and structured way.

- There continues to be 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 also need to be more careful in the precision of the language they use in their descriptions and explanations. For example, in Q22(d), saying that a smaller mass causes "a smaller weight, a smaller force and a slower acceleration" is both imprecise and incorrect. A more precise and correct description would be that a smaller mass causes "a smaller component of weight down the slope, a smaller unbalanced force and so the value of the acceleration is less".

- Most candidates would benefit from practice at giving descriptions and explanations based on formulae. For example, in Q23(c), they should be able to argue that the total mass of the expanded gas is constant, its volume is greater and so, since $\rho = m/V$, its new density must be smaller.

- Many candidates would benefit from further practice at calculating values of current and voltage in circuits which have two or more resistors connected both in series and in parallel.

- Candidates must be clear about the difference between absolute and percentage uncertainties. They should practise converting from one to the other.

- When quoting a quantity and its absolute uncertainty, candidates should take care to match the number of figures given.
  For example in Q28(b)(iii), it is not appropriate to give the wavelength as $(4.91 \times 10^{-7} \pm 0.2 \times 10^{-7})$ m since that quoted uncertainty implies that the value for the wavelength should have been rounded to 4.9×10^{-7} m.

- Candidates should be encouraged to re-read each question after writing their answer. Doing this will help them ensure that all the instructions and requirements of the question have been completed correctly.

- Candidates should be encouraged to study the content statements and be prepared to use these in their answers. For example, as part of their answer to Q 29, they should be able to say that “the refractive index depends on the frequency of the incident light” (content statement 3.2.4).

- Many candidates need to practise using the following quantities; absorbed dose, absorbed dose rate, equivalent dose and equivalent dose rate. They also need to be clear about which symbols to use for each of these quantities.

- 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.

- In numerical calculations, candidates should round off figures at their final answer only.

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

Statistical information: update on Courses

Number of resulted entries in 2006	8,565

Number of resulted entries in 2007	8,580

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	26.3	26.3	2,256	67
B	25.8	52.1	2,216	55
C	20.9	73.0	1,792	44
D	9.3	82.3	797	38
No award	17.7	100.0	1,519	-

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.