National Qualifications 2014
Internal Assessment Report
Physics

The purpose of this report is to provide feedback to centres on verification in National Qualifications in this subject.

National Qualifications (NQ) Units

Titles/levels of NQ Units verified:

D379 11 Mechanics and Heat (Intermediate 2)
D380 12 Electricity and Electronics (Higher)
D385 13 Mechanics (Advanced Higher)
D386 13 Electrical Phenomena (Advanced Higher)
D388 13 Physics Investigation (Advanced Higher)

General comments

The material provided for the central verification event indicates a general understanding of the requirements of the assessment and the national standards for the Physics Units that make up the National Courses. The material was generally well presented and easily accessible. In almost all cases, assessment decisions were confirmed by internal verification systems.

A small number of centres failed to provide the Outcome 3 material; in some instances the requirements of the national standards for Outcome 3 were not fully understood.

The visiting verification of the Advanced Higher Investigation Unit indicated that generally centres understood the national standards applicable to this Unit. It should be noted, however, that evidence should be marked by the responsible teacher/lecturer, with indication of where the Performance Criteria have been achieved. It is good practice to have carried out internal verification confirming assessment decisions prior to external verification.

Unit specifications, instruments of assessment and exemplification materials

In the case of both visiting and central verification procedures, all centres showed that, generally, the assessors were aware of the Unit specifications and the instruments of assessment with the accompanying exemplification materials associated with the Units. All centres verified centrally used the National Assessment Bank materials for the assessing the Outcomes of the Units. Generally, experiments appropriate to the level of Unit were selected to provide evidence for Outcome 3.

Evidence Requirements

The majority of centres submitted the required evidence for central verification, both the written Outcome1/2 scripts and the practical Outcome 3 report, for the selected Unit.

Five per cent of the selected centres, however, failed to include all the required material.

At Advanced Higher visiting verification, centres generally showed an understanding of the Evidence Requirements. In a number of centres, however, the candidates' records had no indication of assessment taking place during the progress of the investigation.

Administration of assessments

At central verification, there was clear evidence at all levels that the marking schemes for the National Assessment Bank materials were applied carefully, with reference made to the Physics General Marking Instructions. A number of centres had annotated the marking schemes indicating alternative acceptable candidate responses. It should be noted, however, that any annotations should be in line with the Physics General Marking Instructions.

Generally, the material had been internally verified by cross-marking, although in a small number of centres there was difficulty in differentiating between the marks awarded by the marker, and those awarded by the Internal Verifier. Although the experiment chosen for Outcome 3 was at an appropriate level, the candidates' laboratory reports did not always meet national standards. The more limited evidence of internal verification of this material may have led to national standards not always being met for this Outcome.

Verifiers for the Advanced Higher Investigation Unit found that candidates had been provided with guidance as to the requirements of the Unit at the start of the investigation. The information on the planning of the investigation (Outcome 1) in the candidate record was completed well. However, references and contributions made by others to the investigation were often not noted in the candidate record. For Outcome 2, the recording of data and its analysis was generally well documented, with an increased use of Excel or similar computer packages for graphical analysis. Often the treatment of uncertainties was incomplete at the time of external verification, with candidates indicating that this would be tackled during the write-up of the investigation report.

Internal verification of this material had been carried out in the majority of centres visited.

Areas of good practice

Centres had conducted the assessments fairly and consistently. There was increased evidence of internal verification and cross-marking in many centres, particularly for Outcome 1/2 assessments. In one case a reciprocal arrangement operated between two neighbouring centres. Centres whose material showed evidence of cross-marking, even for a sample of candidates, were more likely to achieve consistency with national standards.

In central verification, candidates performed well in assessments related to Outcomes 1 and 2. Overall, application of the marking schemes was good, with use of the General Marking Instructions for Physics. One centre used a pro forma, detailing the marks awarded for each question by both the teacher/lecturer and the Internal Verifier. For Outcome 3, most candidates produced well structured reports in their own words, with clear aims, procedures and

conclusions for appropriate experiments. At Advanced Higher and Higher levels there were a number of good examples of data analysis and uncertainties treatment, with sample calculations shown.

In Advanced Higher visiting verification, a number of examples of good practice were noted. Checklists, designed to track the progress of individual candidates through the Performance Criteria, were evident in a number of centres. The checklists allowed the candidate, the teacher/lecturer, and the Internal Verifier to be aware of the progress of candidates. In many centres, a candidate guide to Investigations was included as part of the candidates' records. In a small number of centres, uncertainties had been noted as part of the recording of experimental data. This allowed candidates to reflect, at an early stage, on the quality of their data. Candidates from a number of centres commented favourably on the balance between supervision/advice and independent study that the Investigation Unit affords.

Specific areas for improvement

When carrying out the assessment process, centres should:

- Ensure the marking of Outcome 3 reports is clear, indicating the location of the evidence supporting the assessment decisions.
- Have a robust system of internal verification, recording the process with dates and signatures.
- Be aware that a Unit cannot be resulted without an Outcome 3 assessment having taken place and passed.
- Stress to candidates the need for care to use correct units when recording values from experimental data. (eg the unit of T^2 is s^2, and the abbreviation for *radians* is *rad.*)

When candidates are preparing the evidence for Outcome 3 reports, centres should:

- Ensure that the conclusion drawn is linked to the aim of the experiment.

- Note that when candidates are graphing experimental data, the points should be clearly and accurately indicated and the best-fit line clearly drawn and extended to the origin if the aim is to verify a proportionality relationship. Care should be taken, however, not to force a straight line to pass through the origin. Should a straight line fail to provide evidence of direct proportionality by passing through the origin, an appropriate conclusion should be given, such as the relationship is 'linear'. Discussion on possible reasons for the result could be addressed in the evaluation.

- Note that graphs produced by Excel or similar computer packages should be of an appropriate size, with both horizontal and vertical gridlines (minor and major), and data points indicated by appropriately sized symbols. Any error bars plotted should reflect the uncertainty in individual measurements.

- Ensure, especially at Advanced Higher, that the treatment of uncertainties is at a level similar to that indicated in the Arrangements document. Consideration of scale reading, random and calibration uncertainties, where appropriate, in a measured quantity would enable candidates to reflect on the precision of measurements in the evaluation. This would hold even if the uncertainty in any final value were taken from a calculation of uncertainty in a gradient.

- Note that random uncertainty can only be used for repeated measurements of a value. Care should also be taken when averaging measurements. In finding a value for 'g' using a simple pendulum for example, if repeated measurements were made of the period of a fixed-length pendulum, it would be valid to take an average of these measurements. It would be invalid to average values of 'g' obtained from a number of different pendulum lengths.

- Ensure that the evaluation at Higher and Advanced Higher levels is appropriate to the level of award. At these levels, 'use a better meter' is not acceptable as an evaluation. It may be more appropriate to reflect on the precision of experimental data, suggesting how the larger uncertainties could be reduced, or to speculate on any systematic uncertainty within the experiment which may have caused a best-fit straight line to 'miss' the origin.