

17 December 2004

To: Director of Education
Head of Centre
SQA Co-ordinator
Principal Teacher of Physics
Teacher with responsibility for Physics
Physics Lecturers

For the attention of all staff responsible for the delivery of National Qualifications in Physics

Action by Recipient	
	Response required
	Note and pass on
✓	None — update/information only

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Dear Colleague,

National Qualifications Update — Physics

This letter is intended to provide centres with information on developments in National Qualifications in Physics.

Moderation Issues

Retrospective moderation of AH Physics Investigation took place in August. Twenty centres were selected and required to submit evidence for the Unit assessment of the Physics Investigation. This should be the candidate's ongoing record of the work they have undertaken and is often in the form of a 'daybook'.

There are two Outcomes that candidates must achieve in order to attain a pass in the unit assessment

- ◆ Outcome 1: Develop a plan for an investigation
- ◆ Outcome 2: Collect and analyse information obtained from the investigation

Details of the Performance Criteria that support these Outcomes can be found on pages 14 and 15 of *Physics Investigation D388 13/NAB001* issued in August 2002 (this replaced the version from April 2000). The NAB can be obtained online from SQA's secure website (see your SQA coordinator for access).

Of the 20 centres moderated, issues were identified in 16.

In the majority of centres, very little of evidence of planning was identified. One purpose of the investigation is to help promote good scientific practice and as such the 'daybook' should form a proper, working scientific document of the investigation undertaken by the student.

This **must** include the relevant planning, such as:

- ◆ the aim/purpose of the investigation
- ◆ the rationale behind why particular methods have been chosen or why ideas have been rejected
- ◆ notes on the design/selection of experimental methods
- ◆ notes on research undertaken
- ◆ contributions made by others.

For Outcome 2 the record of work **must** include both the results taken **and** the analysis of these results:

- ◆ tables of results must have correct headings, Units and correctly entered readings
- ◆ analysis of results should be presented in an appropriate format, this could be tabular, graphical or often both
- ◆ appropriate treatment of uncertainties

Some centres indicated that this information was included in the final report and not in the 'daybook', however, 'evidence submitted for moderation must include all of the evidence that you use to determine that each candidate included in the moderation sample has achieved this unit. For each candidate the evidence must cover both Outcomes of the Unit.' (page 18 of NAB)

Good scientific practice would be to analyse results and uncertainties in the 'daybook' before they are committed to a final report, this way candidates would have a better idea if experiments had been successful or whether further work was necessary. In some of the centres for whom no issues were identified, graphs were either photocopied or two copies printed (one for the daybook and one for the report), this was deemed to be appropriate and avoided unnecessary duplication of graphical work.

It is important that centres understand that the 'daybook' or record of work forms the assessment for the Unit and that the Unit requirements are not simply a continuation of the function of the 'daybook' for CSYS physics. The evidence for the NAB **must** be marked by the responsible teacher/lecturer and internal moderation is desirable, if resources permit. Successful centres had adopted a strategy of either marking on the 'daybook' when PCs had been passed or using the proforma provided in the NAB.

A large number of the issues identified could easily have been avoided if candidates had been issued with, or made use of, the Candidate's Guide on pages 22–24 of the NAB.

When starting investigations candidates **must** be issued with the appropriate documentation

- ◆ Candidate's Guide (pages 22–24 Physics Investigation D388 13/NAB001)
- ◆ Guidance on course assessment for candidates (www.sqa.org.uk)

Centres should note that if they have candidates who have passed the unit assessment for the investigation but have not submitted an investigation report for the external assessment, then the centre is likely to be selected for retrospective moderation.

Preparations are currently underway for central moderation, next Easter.

Centres are reminded that if selected for Standard Grade moderation they must submit a **complete record** of the candidates' attempts at the Practical Techniques. It is a requirement of the Course that candidates are given the opportunity to attempt all eight techniques, and **not** simply sufficient techniques to take them above a grade boundary.

On occasions, due to absence, pupils may miss a technique. It is essential, in these cases, that the record or flyleaf has some comment to reflect this.

Please note that a blanket letter saying that all candidates were given multiple opportunities to attempt the techniques will **not** be accepted in place of a complete record.

If selected for NQ moderation centres are reminded that they must submit both a NAB test, or equivalent, and a complete Outcome 3 report, and that this report should be marked, either by annotating the actual report or by using the proforma provided in NAB001 of each Unit.

Electronic Marking of Objective Tests

The SQA has decided to adopt electronic marking of the objective test sections of examinations. This will be introduced in the 2005 diet of examinations. In Physics, this will currently affect Intermediate 2 and Higher examinations. This step is being introduced as part of SQA's continuing process of improvements and will mean that candidates will use a new format of answer sheet that will include their pre-printed personalised details. Exemplar materials showing the format of the answer sheets and the instructions for use will be distributed to all centres and posted on SQA's website. This will allow both centres and candidates to become familiar with the new format prior to sitting examinations.

Further information is available on SQA's website and centres will be kept informed of progress via the 'NQ News' section.

Professional Development Workshops

At the start of October SQA ran a workshop detailing how Higher Physics is marked. This was aimed at helping practitioners understand the procedures and standards applied at this level. Around one hundred Physics teachers from across Scotland attended the event and the workshops were very well received by the delegates.

A big vote of thanks goes to the Higher Physics Examination team for their hard work and dedication in preparing and running the workshops and making the event such a success.

It is hoped that this type of workshop will become a regular event in the Physics CPD calendar.

For those that weren't able to attend the materials can be purchased from SQA using the link on the Physics page of the website.

Online Marking Materials

SQA has been leading the development of a new website which will explain how external assessments for National Qualifications are marked. This website is designed specifically for teachers/lecturers rather than pupils or parents and its aims are to explain the principles underlying the marking of assessment evidence and to develop, interactively, the user's skills in applying these principles to a selection of candidate responses. The website is scheduled to be launched nationally late in November 2004 with an initial group of around a dozen high-uptake subjects which includes Physics. Details of how to access the website can be obtained from your SQA coordinator.

Changes to Physics Examinations

The format of the **Intermediate 1** Physics exam is to change.

For the 2006 exam the total mark is being reduced to 80 (from the current total of 84) but the time allocation will remain unchanged.

For the 2007 examination, and beyond, the format will become similar to that for Intermediate 2 and Higher Physics, with section A comprising 20 multiple-choice questions and section B comprising 60 marks of extended answer questions of the type that currently make up the paper. The balance of KU and PS will remain the same.

A number of centres will be invited to participate in the pre-testing of multiple-choice questions for Intermediate 1.

For the 2006 examination, and beyond, **Intermediate 2** Physics is to incorporate a **data sheet** similar to those in other Physics papers, but appropriate to the level. A copy of the data sheet will be placed on the Physics page of the website once it has been prepared.

Revision of Arrangements Documents

Revised versions of the arrangements documents for Higher and Advanced Higher Physics courses **leading to examinations in 2006 and beyond** will be available on SQA's website before Christmas.

Candidates undertaking examinations in Physics in 2005 should continue to be taught using the current arrangements documents.

Minor changes have been made to Content Statements to improve the consistency of style across Physics courses at all levels. The requirement to state some of the mathematical relationships has been removed with emphasis moved to carrying out calculations involving the relationships between quantities.

Terminology relating to the dosimetry section of the Radiation and Matter unit has been updated to reflect current practice. In particular the term ‘Quality Factor, Q ’ has been replaced with the term ‘radiation weighting factor, w_R ’ and ‘dose equivalent’ has become ‘equivalent dose’. The appropriate changes have already been made to Standard Grade and Intermediate 2 arrangements.

The term ‘intensity’, when referring to e-m radiation, has been replaced with the term ‘irradiance’, which is the correct terminology for the quantity measured in Wm^{-2} . The abbreviation is still I and the relevant formulae remain unchanged.

More details on the changes can be found in the appendices to this update letter.

Recent Publications

Centres are reminded that the Principal Assessor and Senior Moderator reports for 2004 are available on the Physics page of SQA’s website. It is recommended that centres download these as they contain a wealth of information that can be used to inform learning and teaching.

The 2004 Marking Instructions for Intermediate 1, Intermediate 2, Higher and Advanced Higher Physics are also available on the website.

NABs

NABs for Higher Physics are currently being revised to take account of the updated terminology in the Radiation and Matter Unit.

These revised NABs for use with Higher Physics **leading to examinations in 2006 and beyond** will be available on the secure website (see your SQA Co-ordinator).

Candidates undertaking examinations in 2005 should continue to use the present version of the NABs.

The following changes to questions have been made:

- ◆ intensity, I , has been changed to irradiance, I
- ◆ quality factor, Q , has been changed to radiation weighting factor, w_R
- ◆ dose equivalent has been changed to equivalent dose
- ◆ $H = DQ$ has been changed to $H = Dw_R$, in the marking instructions

Access 3 / Intermediate 1

I have received a number of enquiries relating to entries for Access 3/Intermediate 1 Physics. In particular what to do about pupils who have a number of unit passes at Intermediate 1 and a number of Units at Access 3, or what to do about a pupil who passes all Units at Intermediate 1, but then fails the exam.

In the first instance queries regarding entries should normally be made through your SQA Co-ordinator to your CAM (Customer Accounts Manager).

In cases where there is a hierarchy of Units, such as between Access 3 and Intermediate 1, candidates can be resulted at either the level above or the level below the one they were originally entered for, on the results submission form. A candidate can therefore be resulted with a mixture of unit passes for different levels (note this does not apply where there is no hierarchy of Units). If candidates have been entered for the Intermediate 1 Course and they have not passed all the Units at that level, the entry should be changed to Access 3.

Deadlines for submissions of entries can be found in the Operational Guide, which can be accessed online or from your SQA Co-ordinator.

One way round this is to make a dual entry at Access 3 and Intermediate 1 and then withdraw the candidate from one when you know which level they should be entered for, though centres must be aware that they will be charged for each Course entry

In the case of a candidate passing all Units at Intermediate 1 and then failing the exam, the candidate will have the Unit passes on their certificate, but in order to be credited with the Access 3 cluster they must be re-entered at this level and they would receive an amended certificate at a later date, with no requirement for re-assessment.

Appeals

Although the success rate for appeals increased for most levels of Physics this year, the most common reason for an appeal failing was still **incomplete evidence for the Course**. This was particularly the case for Standard Grade and Intermediate 1. It is important that when submitting appeals the evidence demonstrates candidate attainment across the whole Course. Centres are reminded that for an appeal for a grade C a **high scoring** NAB may be submitted as additional evidence, but this is not valid evidence to support an appeal at A or B.

Centres are also reminded that only the current years' commercial papers can be used in their entirety and there is an important caveat that centres must check the standard of these before using them. SQA does not validate commercially produced papers in any way. Unfortunately a significant number of centres did not follow the advice on use of commercial papers this year.

Exemplification material for Higher appeals was published and distributed to centres, but this was intended to demonstrate the type of evidence that would be suitable for submission, it was not intended to be used as the evidence. Centres are requested not to use the exemplar material, which is a public domain document. Similarly, centres are reminded that the specimen question papers on SQA's website are not suitable sources of evidence.

Centres are referred to SQA's publication '*Estimates, Absentees and External Assessment Appeals: guidance on evidence requirements April 2004*', which contains clear guidance on generating evidence.

As an aid to producing appropriate evidence, grids, similar to those used by the examining teams for checking Course coverage, are included in the appendices. Examiners will look for

as many as possible, of the areas listed, to be covered. A grid for Standard Grade has not been included; centres need to ensure they submit evidence covering **all seven** Units.

A further grid, which was identified an example of good practice, for detailing the breakdown of content and sources of evidence is included. Some entries have been filled in to show how the grid was completed and a blank grid is also included. The term PS+ is used by the Physics teams to describe 'A' standard questions.

Review of NQ Physics Courses

The Scottish Executive Ministerial response to the 3–18 Curriculum Review was published on 1 November 2004. The response stated:

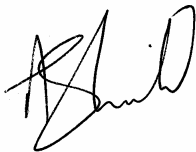
'A cycle of continuous updating and reform of the curriculum across all areas of learning will begin immediately, starting with the science curriculum 3–18.'

This is an important opportunity to take a fresh look at the NQ Physics Courses (Access 3 to Advanced Higher). A Physics Subject Advisory Group has been set up to consider initial ideas and produce proposals for reviewing these courses, which will then be taken to a wider consultation. The work of the group is about to get underway and centres will be kept informed of progress via the update letters and SQA's website.

I hope you find the information in this letter helpful. If you require any clarification please do not hesitate to contact me.

I can be contacted in a number of ways, through e-mail using the address or direct phone number on page 1 and also via the e-mail link on the Physics pages of SQA's website (www.sqa.org.uk).

Yours faithfully



Andy Shield
Qualifications Manager
Maths, Science & Languages Unit
Qualifications Directorate

Appendices

Appendix A

Changes to arrangements documents

Level	Minor Amendments	Statements Deleted(old)	New Statements Added
Higher	1.3.2, 1.4.10, 1.5.8 2.3.5, 2.3.9, 2.4.6, 2.4.11 3.1.8, 3.1.9, 3.1.11, 3.2.12, 3.2.13, 3.3.7, 3.3.8, 3.3.14, 3.3.15, 3.4.8 <i>Change in terminology: 3.3.1, 3.3.2, 3.3.3, 3.3.5, 3.3.6, 3.3.9, 3.3.33</i> <i>Area 3.5: new terminology, minor changes to some outcomes, reordering of outcomes</i>	2.1.6, 2.1.15, 2.2.2, 2.3.8 2.4.5, 2.4.10, 3.1.2, 3.2.4, 3.2.7	3.2.6, 3.3.16
Advanced Higher	1.1.3, 1.1.5, 1.2.4, 1.2.6, 1.2.9, 1.2.10, 1.3.8, 1.3.9, 1.3.11, 1.3.12, 1.4.2, 1.5.3, 1.6.5, 1.6.9, 2.1.2, 2.1.9, 2.1.11	1.2.3, 1.3.2, 1.3.6, 1.4.1, 1.4.7, 1.6.3, 1.6.8, 2.1.1, 2.1.5, 2.1.13, 2.2.5	1.1.7, 1.2.5, 1.3.5, 1.3.9, 1.5.7

Appendix B

Content Tables

Advanced Higher Physics			
Mechanics	Electrical Phenomena	Wave Phenomena	
Kinematic rels & rel motion	Electric Fields	Waves	
Angular Motion	Electromagnetism	Interference — div of amp.	
Rotational Dynamics	Motion in Magnetic Field	Interference — div of wavefront	
Gravitation	Self-inductance	Polarisation	
SHM	Forces of Nature		
Wave-particle duality		Uncertainties	
		Integration	
KU	PS	PS+	
Total mark for paper	Additional evidence, eg high scoring NAB, 2nd prelim, other		Yes/No

Higher Physics			
Mechanics and Properties of Matter	Electricity and Electronics	Radiation and Matter	
Vectors	Electric Fields & Resistors	Waves	
Equations of Motion	AC current & voltage	Refraction of Light	
Newton II, Energy & Power	Capacitance	Optoelect. & Semiconductors	
Momentum and Impulse	Analogue Electronics	Nuclear Reactions	
Density and Pressure		Dosimetry and safety	
Gas Laws			
		Uncertainties	
		Integration	
KU	PS	PS+	
Total mark for paper	Additional evidence, eg high scoring NAB, 2nd prelim, other		Yes/No

Intermediate 2 Physics			
Mechanics and Heat	Electricity and Electronics	Waves and Optics	
Kinematics	Circuits	Waves and Optics	
Dynamics	Electrical Energy	Reflection	
Momentum & Energy	Electromagnetism	Refraction	
Heat	Electronic components		
		Radioactivity	
Integration		Ionising radiations	
		Dosimetry	
		Half-life & safety	
		Nuclear reactors	
KU	PS	PS+	
Total mark for paper	Additional evidence, eg high scoring NAB, 2nd prelim, other		Yes/No

Intermediate 1 Physics			
Telecommunications	Practical Electricity	Radiations	
Radio	Electrical circuits	Light	
Television	Resistance	X-rays	
Satellites	Mains Electricity	Gamma rays	
Optical Fibres		Infrared & ultraviolet	
Telephone			
Sound & Music	Movement	Electronics	
Sound Waves	Forces	Input, process & output	
Speed of sound	Speed and acceleration	Digital logic gates	
Using sound	Moving objects		
Amplified sound		Integration	
KU	PS	PS+	
Total mark for paper	Additional evidence, eg high scoring NAB, 2nd prelim, other		Yes/No

Content	Prelim Coverage	Marks	Mini Prelim Coverage	Marks	Sources
1.1 Vectors	Q1, 2, 21(a)	5	Q2	1	H97, SCEH00, HSDU
1.2 Equations of motion	Q3, 22 (a), (b)	6			H95, H96
1.3 N2, energy and power					
1.4 Momentum and impulse					
1.5 Density and Pressure					
1.6 Gas Laws					
2.1 E-fields and resistors					
2.2 A. C. I and V					
2.3 Capacitance					
2.4 Analogue Electronics					
3.1 Waves			Q1, 11(a), (b)	5	P&N00, H99
3.2 Refraction of light					
3.3 Optoelectronics and semiconductors					
3.4 Nuclear Reactions					
3.5 Dosimetry and safety					
4.2 Uncertainties					
Integration	√		√		
PS+		28		14	

EXEMPLAR

Content	Prelim Coverage	Marks	Mini Prelim Coverage	Marks	Sources
1.1 Vectors					
1.2 Equations of motion					
1.3 N2, energy and power					
1.4 Momentum and impulse					
1.5 Density and Pressure					
1.6 Gas Laws					
2.1 E-fields and resistors					
2.2 A. C. I and V					
2.3 Capacitance					
2.4 Analogue Electronics					
3.1 Waves					
3.2 Refraction of light					
3.3 Optoelectronics and semiconductors					
3.4 Nuclear Reactions					
3.5 Dosimetry and safety					
4.2 Uncertainties					
Integration					
PS+					