

IOP Institute of Physics

Andrew Shield
Qualification Manager (Physics)
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7th March 2011

Dear Mr Shield,

Revision of Advanced Higher Physics

Please find attached the Institute's responses to the questionnaire on the proposed revisions.

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 40,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

Yours sincerely



Prof Andrew Long
Chair, IOP in Scotland



Prof. Peter Main
Director of Education and Science

Advanced Higher Physics Questionnaire

1. CONTENT

1. To what extent are the unit and topic titles appropriate to AH Physics?

The unit and topic titles are appropriate. We welcome the decision to make the unit titles different from those in the Higher course, since this emphasises to candidates that the Advanced Higher is not just “more of the same stuff.” It also sends a message to school managements that dual level teaching of Higher and Advanced Higher is not appropriate.

2. To what extent is the proposed new content appropriate to AH Physics?

We recognise that there will never be total consensus amongst the teaching profession on exactly what content should be included in a new course. Nevertheless, we congratulate the Qualification Design Team on achieving a good balance between old and new.

Topics such as Space and Time, Stellar Physics and Particle Physics should capture the imagination of candidates and will hopefully make it easier to sell this course to our students.

We do have some concern about the total volume of content, particularly in the 20 hour Electromagnetism unit, and would anticipate some difficulty in covering the content of this unit in the time available.

Many respondents have indicated a preference for more detailed content statements for the new content, to help us understand the depth of treatment required.

3. What are your views on the proposed removal of content?

It is not clear exactly what is being removed from the Electromagnetism unit. For example there is no mention of fields around charged conductors, although some knowledge of these fields is needed when considering the motion of charged particles in electric fields.

It seems incongruous to remove the helical movement of charged particles in magnetic fields at the same time as introducing work on the interaction of the solar wind with the magnetosphere.

It is disappointing that so many of the derivations from the old AH course have been removed. An understanding of where an equation comes from is important and inexperienced teachers might be tempted to simply present the equations to their students, leading to knowledge without understanding.

4. Do you have any suggestions for further deletions or additions to content? If you are suggesting further additions, what, if anything, would you remove to create space for your suggested content?

The sub-topic on impedance would be a candidate for removal, since it is hardly cutting edge physics. We recognise the importance of this topic, but this would be our preferred option for removal.

The Stellar Physics topic also looks to be rather “bolted on”, although as noted earlier this is likely to be attractive to candidates.

2. ASSESSMENT

1. It is proposed to use the new Outcomes and Performance Criteria in the Revised Higher for the Revised Advanced Higher (see PowerPoint presentation or the Arrangements Document for Revised Higher Physics).

To what extent are the Outcomes and Performance Criteria appropriate to AH Physics?

The Outcomes and Criteria are entirely appropriate.

2. A style of question called an ‘Open Ended question’ is being introduced in the Revised Higher. These questions involve asking candidates to demonstrate their knowledge and understanding in less structured situations and are marked in a more holistic fashion.

To what extent is it appropriate to include Open Ended Questions in AH Physics Assessments?

Open ended questions allow candidates to demonstrate a depth of understanding which is not possible in traditional type questions. For this reason we are very much in favour of their introduction.

As an aside, we would not be concerned if the contexts for such questions were not all at AH level since the complexity of the response can compensate for this.

3. What are your thoughts on including objective type questions (multiple choice) in AH assessments?

The inclusion of a set of multiple-choice questions permits the examiner to test a wider sample of content than would otherwise be the case.

However, if such questions are to test more than trivial straight recall of knowledge then candidates are required to invest a disproportionate amount of time and work for just one mark.

For this reason we would not be in favour of their introduction.

3. THE INVESTIGATION

The Investigation will continue as an important part of Advanced Higher; however the revision of Advanced Higher presents an opportunity to look at issues surrounding

the Investigation, in particular the internal assessment (the 'daybook') and the marking of the external assessment.

1. What are your views on the current Unit assessment of the Investigation (the 'daybook')? Given that a Unit must have internal assessment, how could the Unit assessment for the Investigation be improved?

The greatest difficulty that teachers experience in this area is in actually persuading the students to keep a record of their work as they go along. Students might be more amenable to this task if more stress was placed on "alternative" methods of record-keeping such as e-portfolios. Exemplification of good record keeping would also help.

2. What are your views on the current course assessment for the Investigation (the report)? How could the course assessment or the criteria used for marking the course assessment be improved?

The current assessment scheme for the report, with its emphasis on data handling, severely constrains the types of investigation that can be carried out, and leads to the "three related experiments" type of investigation, where candidates simply follow a recipe.

Too many marks are available for rather trivial "tick-box" criteria.

A more holistic approach to assessment would perhaps encourage a more genuine investigative approach.

3. Any further suggestions for improving the Investigation Unit?

There is perhaps an overemphasis at the moment on ensuring the content of the investigation is "commensurate" with the AH course. The investigation is a demonstration of skills rather than subject knowledge, and therefore the way in which the investigation is carried out is surely more important than the actual physics being investigated.

Candidates should be encouraged to pay more attention to improving and refining their procedures and the marking scheme should reflect this.

4. UNCERTAINTIES

1. How much progression should there be in the use of uncertainties in AH compared to Higher? More, less or the same as the existing AH arrangements?

There is evidence (anecdotal) from the universities that undergraduates have a poor understanding of experimental uncertainties. We feel that this is partly due to the fact that we do not give this area the attention it deserves in our current courses.

We would not be in favour of simply using the Higher outcomes for uncertainties since this might give candidates the impression that uncertainties are unimportant.

Opinion is split on whether we should retain the current AH arrangements, or extend them to include confidence levels, which should promote a better understanding of experimental uncertainty.

It should be noted that there are different acceptable approaches to dealing with uncertainties, and examination questions which focus on one approach such as the parallelogram method for the gradient of a graph should be avoided.

2. Any suggestions for improving the treatment of uncertainties?

Teachers must be encouraged to discuss uncertainties with their students on a regular basis, and to demand that students consider the uncertainties in every experiment they carry out. Students should be encouraged to use spreadsheets to avoid the time consuming drudgery of manual calculations. More emphasis should be placed on the evaluation and origin of uncertainties.