



General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Report on the Examination

2007 examination - June series

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Physics

Higher Tier PHY1H

General

The paper seemed accessible to the majority of candidates with questions appropriate to each grade within the tier. There were few scripts with blank spaces or inappropriate answers. There was no evidence that candidates had insufficient time to complete the paper. It was pleasing to read many good answers to the questions related to the 'How Science Works' part of the specification.

Question 1 (*Standard Demand*)

This question was not as well answered as would have been expected. Many candidates were unable to recall basic facts or apply the information given in the question.

In part (a)(i), whilst many candidates described sources of gamma radiation or the effects of gamma radiation, most failed to refer to it as electromagnetic radiation. In part (a)(ii) many candidates realised the significance of gamma being the only type of radiation which would pass through the packaging; but common incomplete answers just described properties of gamma radiation without referring to the situation described. A significant number of candidates referred to the ability to kill bacteria rather than to the penetrating power. Part (a)(iii) was poorly answered with less than half the candidates scoring the mark.

Part (b)(i) was well answered, although a significant number of candidates referred to the gamma radiation as being 'trapped' in the concrete. In part (b)(ii) it appeared that many candidates had not read the question thoroughly and referred to changing the source. Those candidates that had read the question made sensible suggestions.

In part (c)(i) it appeared that many candidates had the correct idea of testing the irradiated food on people or animals or measuring levels of radiation, however many candidates were let down by their inability to express themselves clearly. In part (c)(ii) a pleasing number of candidates realised that the answer should refer to people being able to make an informed choice or decision as to whether to eat the treated food or not. However, despite the tone of the whole question, a significant number of candidates answered in terms of people getting cancer from eating the food, or an 'overdose' if they were receiving treatment for cancer.

Question 2 (*Standard Demand*)

This question was generally well answered. The majority of candidates were able to answer parts (a) and (b) correctly although in part (b) there were a number of candidates that misread the scales.

Part (c) was poorly answered. Many candidates simply said 'because it's hotter' or gave a description of the process of heat loss. Few candidates identified the temperature difference as the key factor.

In part (d) there were many well-written answers; candidates argued succinctly and logically. But absorption, emission and reflection are badly understood and many candidates who thought can L was white gained no credit. Many candidates thought that because black is a good absorber it would continue to absorb heat which would keep it hotter.

Question 3 (High Demand)

This question was generally well answered.

Answers to part (a)(iii) contained a lot of errors. Common mistakes involved the idea of spreading electricity round the country better or making sure there was enough to go round. Many candidates think that voltage had to be high in the cables so that it can be shared by all the consumers.

The answer to part (b) was well known. The few candidates that did not gain credit had not read the question properly and gave answers in terms of fossil fuels running out.

In part (c) reasons against wind farms were better known than arguments in favour of wind farms. In part (c)(i) most candidates made at least one acceptable point but some candidates only talked vaguely about wind power being environmentally friendly without giving any examples and/or that wind power is free once the wind farm has been built. In part (c)(ii) the majority of candidates made two good points. The most common answers included visual pollution, noise pollution and the unreliability of wind. A significant number of candidates referred to bird related problems.

Question 4 (High Demand)

Part (a) was generally well answered. The link between increasing wavelength and decreasing frequency was usually correctly identified. Some candidates referred to amplitude correctly, although irrelevant to the question.

Part (b) was poorly answered. Those candidates who had the right idea could often not express themselves clearly enough to gain credit. Many candidates were thinking about sending signals rather than receiving them.

Part (c) was poorly answered. In part (c)(i) many candidates failed to gain credit because they answered in terms of what the red shift tells us rather than what it is. Some candidates with the correct idea referred to the star or galaxy moving to the red end of the spectrum, rather than the radiation. In part (c)(ii) many candidates did not gain credit because they gave a generalised answer about red-shift rather than the red shift of the particular star in the question.

Although there were some good answers to part (d)(i) there were also many misconceptions, e.g. confusing the big bang with supernovas or with the creation of the Earth and the creation of life on Earth. Some candidates understand the big bang as an interim stage; 'all the galaxies came together and exploded'. Whilst a number of candidates talked of matter being created by the explosion. In part (d)(ii) many candidates understood the need to check the reliability of the evidence.

Question 5 (High Demand)

In part (a)(i) there were many correct answers. The most common error was 'a signal that can be turned on and off'. Few candidates scored both marks in part (a)(ii). A significant number of candidates divided by 75cm arriving at an answer of 4,000,000.

Part (b)(i) produced a wide range of answers; however few candidates scored all three marks. Many candidates scored two marks for the idea of 'microwaves damaging cells'. Most candidates scored at least one mark in part (b)(ii) with almost half scoring full credit. The idea that research could be biased and the need to present the evidence was well known.

Question 6 (High Demand)

In part (a) those candidates who chose the payback route generally gained no credit, unless they picked the boiler as the best option. Many candidates scored two marks for selecting the

boiler and a correct calculation. A significant number of candidates scored all three marks for completing all the calculations correctly and making the correct choice.

Few candidates scored 2 marks in part (b). Most candidates failed to link the less energy back to the power station. The common mark scored was for stating the reduction in fuel burnt. Many considered the efficiency of the bulbs; but did not link it back to the need to generate less electricity. Very few thought about the need for fewer bulbs and the energy saving in their manufacture. There were a significant minority of candidates who thought that conventional light bulbs emit carbon dioxide or that energy loss somehow produces carbon dioxide, often as a result of heat loss.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.

Centre Assessed Unit

General

This report covers the first submission for moderation of the Centre Assessed Unit for the new specifications in GCSE Science. Because of the confidential nature of the ISAs, which are still currently operational, it cannot deal with specific references to particular ISAs, but rather deals with the overall general performance of the component this year. Centres that have particular questions about specific ISAs should make enquiries of their Centre Assessed Unit Adviser.

1. Structure of the Centre Assessed Unit (CAU)

The total number of raw score marks for the CAU is 40. This comprises 6 marks from the Practical Skills Assessment (PSA) and 34 marks from the Investigative Skills Assignment (ISA).

The ISAs may be used for more than one subject. Six were available this year which could be used for the new specification subjects.

Moderation is only carried out once per year. Requests for moderation should be submitted in February each year, using the appropriate code:

- Science SCYC – one ISA from B1, C1 or P1
- Additional Science ASCC – one ISA from B2, C2 or P2
- Biology BLYC – one ISA from B1, B2 or B3
- Chemistry CHYC – one ISA from C1, C2 or C3
- Physics PHYC – one ISA from P1, P2 or P3

Centres may also request that the marks for this component are carried forward from one subject to another appropriate subject. For example, if a candidate has previously submitted an ISA in B1 for moderation for Science, this mark may be carried forward for subsequent certification in Biology.

CAU marks must be submitted by May 5th each year. It is the total mark out of 40 (i.e. PSA plus ISA) that must be entered on the Centre Mark Form.

2. Practical Skills Assessment (PSA)

The criteria for the award of these 6 marks are based on 6 “can-do” statements. These may be assessed at any time during the course when candidates are carrying out practical work. The mark should represent the **typical** achievement of the candidate by the end of the course.

Centres are not required to submit any records or justification for their arrival at the final mark, as this component is not moderated. The intention is that the component should be formative and motivating, especially to the lower ability candidates.

Centres appeared to have made a fair and realistic assessment of their candidates. As would be expected if the candidates had shown improvement over the course, the majority of the marks awarded for this component were weighted towards the top of the mark range.

Although no written evidence or justification for the marks is required, conversations with centres have revealed that the vast majority of teachers have either designed their own record form for this or have adopted the suggested format shown on page 32 of the Guidance and Standardising Material for ISA and PSA – Issue No. 1. This booklet is given to delegates at the mandatory Teacher Standardising Meeting. Further copies will be available at meetings this autumn and can also be requested from the Subject Office in Guildford.

The mark for the PSA should be entered in the appropriate space on the reverse of the Candidate Record Form.

3. Investigative Skills Assignment (ISA)

This component comprises the bulk of the marks for the CAU (34/40 marks). Candidates carry out an investigation based on one of the ISAs set by AQA. This year 6 different ISAs were available; 2 each in the context of B1, C1 and P1. Centres may get candidates to carry out all of the ISAs if they so wish: for each candidate however, only the one ISA that resulted in the highest mark is submitted for moderation. Unlike the previous Sc1 scheme, all the ISAs are moderated as a single subject. The teachers need to standardise across all the ISAs and all subjects and will receive one feedback form.

The six ISAs available this year were:

- B1.1 – Fieldwork
- B1.2 – Reaction Times
- C1.1 – Unsaturation of Oils
- C1.2 – Viscosity of Oils
- P1.1 – Thermal Insulation
- P1.2 – Wind Turbines

By far the most popular ISAs were B1.2, C1.2 and P1.1. Some centres carried out C1.1 but there were very few instances of B1.1 and P1.2 being carried out.

3.1 Teacher support for the ISA

Initially teachers were very concerned about the new specification, particularly because the Centre Assessed Unit represented a marked change from the old Sc1 scheme and would now be worth 25% of the total certification mark. However, in the last 6 months, teachers seem to have become much more at ease with the new scheme. They seem particularly pleased with the requirement that all of the work is done under the direct supervision of the teacher; nothing gets taken home.

Over the last 18 months, AQA's Teacher Support Department has run a number of different presentation meetings all over the country to explain the requirements of the new specifications.

In addition to these presentation meetings, AQA has also run a large number of half-day standardisation meetings for teachers. These meetings will be repeated in the autumn and spring terms of the next academic year. At these meetings, teachers are provided with standardising material and are able to ask questions about the ISAs.

3.2 Internal standardisation and the Centre Declaration Sheet

It was apparent to moderators that those centres that had sent a teacher to a standardisation meeting were far less likely to have their marks adjusted. However, it is a requirement that if more than one teacher at a centre is responsible for the marking, a procedure of internal standardisation is carried out. The easiest way to do this is for the teacher who attended the meeting to use the exemplars and PowerPoint presentations that were provided at the standardisation meeting.

In some cases, it was apparent to moderators that such internal standardisation had not taken place. This did result in the marks of candidates at some centres being changed.

Centres are required to complete a Centre Declaration Sheet confirming that internal standardisation has taken place, and submit this to the moderator. Moderators reported that in several cases centres had failed to do this, and had to be reminded to submit the form. This slows down the moderation process and in extreme cases may lead to the delay in the issue of results to a centre.

3.3 Provision of ISAs

The fundamental basis of the new scheme is that coursework should be part of the teaching and learning process, and not a “bolt-on” extra, as Sc1 appears to have become in some cases. Teachers are provided with an outline of each ISA as early as March of the previous academic year in the publication of Teachers’ Notes. This enables them to plan in advance when an ISA will fit into their teaching scheme.

The ISA tests and corresponding marking guidelines are issued to the Examinations Officer on a password-protected CD in September although this year, the CD was despatched in June. Science departments are entitled to be given one printed copy of each ISA and marking guidelines, which they should keep secure within the department. Other copies should be printed off as and when required for issue to candidates but these should also be kept secure at all times.

3.4 Operation of ISAs

Candidates carry out an investigation, having been provided with an outline plan by the teacher. They subsequently take the ISA test. Section 1 of the ISA asks them questions about their own investigation, the questions being based upon Section 17 of the specification, “How Science Works”. Section 2 of the ISA describes a situation in the same related area, and asks them questions about this.

Pages 34 to 39 of the Teachers’ Guide provide details of the three stage process in administering an ISA.

3.4.1 Stage 1

(a) The task

AQA provides teachers with a suggested approach to carrying out the investigation. However, AQA cannot provide detailed instructions, as conditions and availability of equipment will vary greatly from one centre to another. Teachers should therefore carry out their own risk assessments of any procedure used.

Teachers may adapt or amend the suggested approach as long as they address the area of investigation detailed in the Teacher’s Notes for each ISA. This enables teachers to tailor the investigation to fit in with their own teaching scheme and the particular class taking the ISA. Whether or not the suggested approach has been amended, centres must complete an ISA Explanation Sheet which gives details to the moderator of how the investigation was carried out. In some cases this year this was not done. Consequently moderators had great difficulty in confirming the award of marks in Section 1 of the ISA.

Teachers need to provide candidates with an *outline* method of carrying out the investigation. Where this is done by means of a printed worksheet, a copy of this should be provided to the moderator.

(b) The table of results

At the end of Stage 1, candidates must, *on their own*, produce a blank table ready for the results. This needs to be marked by the teacher before the candidates proceed to carry out the practical investigation.

The table should be able to accommodate all the data that the candidate is actually going to measure and record during the investigation. There is no need for columns to be provided for repeats, averages or any derived values. These may be included in the table if the teacher so wishes, but there are no marks awarded to their provision.

In some cases teachers had returned these tables to candidates after marking them. If the candidate subsequently alters the table (e.g. by adding units previously omitted) the teacher

should annotate the table. Failure to do so made it difficult for moderators to assess whether or not the correct mark had been awarded.

Some teachers adopted the policy of either photocopying the original blank table before returning it to the candidate, or after collecting the blank table issuing the candidate with a blank table provided by the centre. Either of these strategies is perfectly acceptable.

The mark for the table (0, 1 or 2) should be entered in the right-hand margin adjacent to the last question in Section 1 of the ISA. Failure to do so this year led to some teachers arriving at an incorrect total mark.

3.4.2 Stage 2

(a) The practical work

Candidates now carry out the practical work, working in small groups if necessary. It is important that each candidate should take part in this practical session. Any candidate who does not take an active part in this stage should not be allowed to submit marks for Section 1 of the ISA.

It is also important that each candidate should, wherever possible, obtain his or her own results. Only if this proves impossible should a teacher issue a candidate with a copy of another candidate's results.

This year moderators found a small number of instances where all the candidates at a centre had been using the same set of results. This is not acceptable. There may be occasions when it is necessary to pool the results of several groups of candidates in order to be able to identify a pattern. An example of this might be a fieldwork investigation. In such cases however, it must be made clear to the moderator which of the results that particular candidate had been responsible for obtaining. This is most easily done by including the candidate's own table of results as well as that of the combined group.

(b) Drawing the graph or bar chart

At the end of Stage 2, candidates must, *on their own*, draw a suitable graph or bar chart. Some of the issues that were identified during moderation are listed below.

- Categorical variables should be displayed on a bar chart
- Continuous variables should be displayed on a line graph
- Discrete variables may be displayed on either a bar chart or a line graph
- The maximum marks to be awarded if the candidate has used the wrong type of display is 3
- Although the convention is to plot the independent variable on the x-axis, there is no penalty for reversing the axes
- Candidates should use a scale in which the data occupies at least one third of the range shown on the axis
- One error is allowed out of every 5 points plotted

The mark for the graph (0, 1, 2, 3 or 4) should be entered in the right-hand margin adjacent to the last question in Section 1 of the ISA. Failure to do so this year led to some teachers arriving at an incorrect total mark.

3.4.3 Stage 3

(a) Taking the ISA test

The final stage involves candidates taking the ISA test. Some centres treated this as a normal examination and used the examination hall. Other centres who felt that it was manageable carried out the tests in the normal teaching room. Either approach is acceptable.

All of the standard procedures for access arrangements that apply to written examinations are available for the ISA. These include the provision of extra time, the use of a scribe and the use of a reader.

The access arrangements should be applied for at the beginning of Year 10 and will be valid for 2 years.

(b) Marking the ISA test

AQA provides teachers with marking guidelines for each ISA. Teachers are required to use their professional judgement in marking the test, which is subsequently moderated by AQA.

One of the main difficulties encountered by moderators was the manner in which teachers marked the scripts. Teachers are requested to mark in red ink, to put a tick in the body of the script for every mark awarded, and to enter a subtotal in the margin. However, many teachers adopted a different policy; if they felt that the candidate's answer was correct, they circled "one mark" and if they felt that it was incorrect they made no mark at all. This often left moderators wondering whether or not the teacher had actually read the answer.

(c) Annotation

The marking guidelines suggest typical answers that a candidate may provide. However, if a candidate provides an answer that, in the judgement of the teacher correctly answers the question, then the teacher should award the mark. In such cases the teacher should provide annotation, either to the ISA or to the marking guidelines or both, to indicate the reasons for the judgement.

The level of annotation on the scripts varied greatly. It is a requirement that teachers should annotate the work to show where and why marks have or have not been awarded. Some centres were excellent in this respect; others put no annotation on at all, leaving moderators wondering why marks had been awarded.

A simple and quick way of providing annotation when the teacher thinks that it is a marginal decision as to whether or not the mark should be awarded is the use of the 'D' for doubt. The way in which this should be used is explained on page 27a of the Guidance and Standardising Material for ISA and PSA – Issue No.1.

Some centres adopted this policy this year and in doing so made it much easier for moderators to approve their marking standards. All centres are encouraged to employ this strategy in the future.

At no time should live ISA papers be given back to the candidates.

4. Administrative matters

Comparatively few centres requested moderation this year. The reason for this was that there was no need to submit for moderation unless the centre required certification this year. Some centres entered just a few candidates for moderation in order to obtain feedback.

Some centres were confused between the old and the new specifications, and entered for the wrong one. In addition, there were many centres that did not realise that if they wanted certification in 2007 they needed to submit for moderation this year. Consequently there was a rather large number of late entries. Often, even if the entry had been made on time, the provision of the sample to the moderator was late.

Moderators have reported that although there were a few teachers who were either slightly severe or rather lenient in their interpretation of the marking guidelines, the majority were within tolerance. The tolerance on this component was ± 2 out of 34. Comparatively few centres exceeded tolerance, and these were mainly centres that had failed to send a teacher to a standardisation meeting.

4. Submission of work to the moderator

Centres were asked to submit a list of their candidates, ranked by order of the ISA mark. They were also asked to complete an ISA Explanation Sheet, on which they could state whether the method suggested by AQA had been changed or not. Many centres failed to comply with either of these requests.

When submitting the work to the moderator, a completed copy of the Candidate Record Form should be stapled to the front of each ISA. This form should be signed by both the teacher and the candidate. Failure to obtain the candidate's signature can severely delay the moderation process and may result in the candidate not receiving a mark for this unit. This year many centres had to be contacted in order to obtain candidate signatures. Centres are advised to get the candidate to sign the Candidate Record Form at the same time that they complete the ISA test.

The graph/bar chart and the table(s) of results for each candidate should be stapled to the back of the ISA test. Please do not enclose candidates' work in plastic wallets or folders.

5. Conclusions

In summary, the majority of moderators felt that the Centre Assessed Unit had worked well, and that centres had generally welcomed the ISAs. There were some teething problems this year, but it was felt that once centres had become used to the Centre Assessed Unit it would represent a great improvement on the coursework.

The marks were spread over the full range available.

The relationship between raw score marks, UMS values and corresponding unit grades is shown below.

Raw score mark (/40)	UMS mark (/100)	Grade equivalent
34	90	A*
31	80	A
27	70	B
24	60	C
20	50	D
17	40	E
14	30	F
11	20	G
<11	0	U