



**General Certificate of Secondary Education**

**Science B 4462 / Physics 4451**

**PHY1F      Unit Physics 1**

**Report on the Examination**

*2007 examination - June series*

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*Dr Michael Cresswell*, Director General.

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# Physics

## Foundation Tier PHY1F

### General

A common weakness in many answers appeared to be that of candidates ignoring the data provided for them in the question and trying instead to answer the question from recall or general knowledge. There was no evidence to suggest insufficient time to complete the paper.

### Question 1 (*Low Demand*)

In part (a) most candidates could score 2 out of the 4 marks. Surprisingly few candidates knew the voltage of the mains.

In part (b)(i) only the better candidates realised that the waste energy would go into heating the air. An alarming number of candidates thought that the air would become radioactive, electrified, polluted with carbon dioxide or filled with thick black smoke. The most common incorrect answer was simply that it 'pollutes the air'. In part (b)(ii) just over half of all the candidates made the correct choice.

### Question 2 (*Low Demand*)

Most candidates correctly chose coal in part (a).

Part (b) was well answered with most candidates choosing the correct two responses. It was pleasing to note that very few candidates selected more than two answers.

Part (c)(i) was well answered by the better candidates but the weaker candidates produced vague and incorrect answers, such as "because there is very little carbon dioxide in the air". Some candidates described how a wind turbine worked rather than why there was no carbon dioxide produced. In part (c)(ii) the majority of candidates scored at least one mark with many scoring both. Most responses were in terms of visual pollution, noise pollution, reduction in property values and unreliability. However an alarming number of candidates believed that wind-powered generators generate wind, and were thus talking about the danger of all the crops being blown away by the huge winds that would be generated.

### Question 3 (*Low Demand*)

The better candidates were able to score all 3 marks in part (a). The weaker candidates failed to relate the question to the data in the graph, and were therefore putting down answers such as "The curtains were closed at 5 o'clock because that is when it gets dark".

In part (b) most candidates were able to score at least 2 out of the 3 marks, however many candidates thought that double glazing reduced heat lost by radiation.

A pleasing number of candidates were able to carry out the calculation in part (c)(i) successfully. In part (c)(ii) candidates again tended to ignore the data in the table. This led to many answers along the lines of either "Hot air rises" or "If you don't insulate the loft first you are wasting your money on double glazing and cavity wall insulation because of all the draughts in the loft".

### Question 4 (*Low Demand*)

Although a significant number of candidates failed to read the question carefully and answered 'ultraviolet' or 'visible light', and there were many answers of 'sound', the majority of candidates correctly answered part (a)(i). Surprisingly part (a)(ii) was only known by the better candidates.

In part (b)(i) it was pleasing to note that the message concerning the dangers of skin cancer appears to have got through to the majority of candidates. In part (b)(ii) however, the majority of candidates again tended to ignore the data given to them in the graph. Instead they relied upon their general knowledge to provide incorrect answers such as ‘that is when the sun is at its hottest’.

### **Question 5 (Low Demand)**

Most candidates were able to provide the correct answer to part (a).

There were few correct answers to part (b)(i). A common answer was ‘to see into space’. There was a poor understanding of the size of an astronomical telescope; many candidates thought it portable. Lots of uses for a telescope were given rather than answering the question and concentrating on the advantage over a space telescope. Part (b)(ii) was answered slightly better, as many candidates were able to earn a mark for saying “So that you can look at the Earth”. A common misconception was that it had to be better for a telescope to be in space because it would be closer to the stars!

### **Question 6 (Standard Demand)**

Part (a)(i) was very poorly answered, with hardly any candidates stating that gamma radiation was part of the electromagnetic spectrum. Instead, many candidates referred to the effects that gamma radiation would have on the body. Again in part (a)(ii) candidates were referring to general properties of gamma radiation rather than applying their knowledge to the specific situation described in the question. Few candidates answered part (a)(iii) correctly.

In part (b)(i), apart from the candidates who stated that the concrete walls were there to stop the workers from going in, most candidates realised that the thick concrete walls would stop the gamma rays from getting out. Part (b)(ii) was poorly answered. Many candidates that had not understood the diagram or read the question carefully suggested removing the concrete walls or changing the radioactive source.

Most candidates found it difficult to score both marks in part (c)(i). Whilst many candidates had the idea of testing on humans or animals few went on to say what evidence they would look for. It was common to see answers such as “They could print a statement on the food packaging”. If the candidates took the alternative approach of a comparison between treated and untreated food, they again did not state what they would look for in the comparison. In part (c)(ii) many candidates did little more than repeat the question, e.g. “So that they know if the food has been treated with radiation”. However there were a pleasing number of candidates that did realise the importance of having information in order to be able to make an informed decision.

### **Question 7 (Standard Demand)**

Many candidates gave incorrect answers to parts (a) and (b). It was common for candidates to misread the scales in part (b).

Part (c) was very poorly answered, with hardly any candidates scoring the mark. The significance of temperature difference is clearly not understood.

Answers to part (d) demonstrated a basic, widespread, misunderstanding of the absorption and emission of thermal energy. Most candidates stated that can L must be white but many still scored one mark for noting that can L cooled faster than can M. The main reasons for the colour decision seemed to be that white is a good reflector of heat and therefore would have kept the liquid inside cooler or that because black is a good absorber it would continue to absorb heat which would keep can M hotter.

**Mark Ranges and Award of Grades**

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

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## 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 5<sup>th</sup> 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.

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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.



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### 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

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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.

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### 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  $\pm 2$  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