CONTENTS

FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned**.

PHYSICS

Grade thresholds taken for Syllabus 0625 (Physics) in the November 2005 examination.

	maximum mark available	minimum mark required for grade:			
		A	C	E	F
Component 1	40	34	26	22	18
Component 2	80	n/a	46	37	28
Component 3	80	52	28	18	11
Component 4	48	42	32	22	18
Component 5	40	26	19	15	10
Component 6	40	29	22	17	12

The threshold (minimum mark) for B is set halfway between those for Grades A and C. The threshold (minimum mark) for D is set halfway between those for Grades C and E. The threshold (minimum mark) for G is set as many marks below the F threshold as the E threshold is above it. Grade A* does not exist at the level of an individual component.

Grade Thresholds are published for all GCE A/AS and IGCSE subjects where a corresponding mark scheme is available.

Paper 0625/01

Multiple Choice

Question Number	*Key*	*Question Number*	*Key*
1	**B**	21	**A**
2	**B**	22	**B**
3	**A**	23	**D**
4	**D**	24	**B**
5	**D**	25	**C**
6	**B**	26	**C**
7	**B**	27	**D**
8	**D**	28	**C**
9	**B**	29	**B**
10	**D**	30	**A**
11	**A**	31	**A**
12	**B**	32	**C**
13	**A**	33	**A**
14	**D**	34	**A**
15	**B**	35	**B**
16	**B**	36	**A**
17	**A**	37	**A**
18	**C**	38	**B**
19	**C**	39	**B**
20	**D**	40	**A**

General comments

The mean score was 28.633, the target facility being 30. At 6.073, the standard deviation was similar to that for the 2004 paper.

The easiest items, with a facility of over 90%, were **Items 1**, **3**, **5**, **11**, **17**, **20**, **24** and **33**, and the most challenging, with a facility of below 60%, were **Items 9**, **10**, **14**, **15**, **21**, **25**, **26**, **31**, **32** and **39**.

Comments on specific items

Percentages in brackets after an item number show the percentage of candidates choosing the correct response.

Item 1 provided an easy start to the paper, having 96% facility. In **Item 2** (69%), the distractor of choice for nearly all the incorrect candidates was option **C**, as candidates failed to take account of the changing speed. **Items 3** and **5** (both 95%) caused few problems, with **Item 4** (87%) leading 11% to opt for mass as the answer. The density item, **Item 6** (64%), confused several candidates, the majority of them choosing **D**, the cylinder containing the greatest volume of liquid. It would appear that many were not familiar with the method of finding the centre of gravity of a lamina, **Item 7** (61%), since nearly a quarter thought that suspending it from one hole would be sufficient. Although well answered, **Item 8** (85%) lead more than one in ten to choose **C**, the distractor with both forces on the same side of the pivot, even though they cancelled each other. The first really poor response was to **Item 9** (38%), with fewer choosing the key than those believing that nuclear power stations do not use steam; this topic is clearly worth closer attention. In **Item 10** (58%) all distractors were popular, especially **C**, as candidates overlooked the fact that the horizontal motion of the stone gives it kinetic energy at X.

Item 11 (91%), on pressure due to the weight of a solid, was well answered, but in **Item 12** (62%) more than one in four opted for **A**, taking the length of the space above the mercury as an indication of atmospheric pressure. With a facility of 78%, **Item 13** indicated that the most common error was to believe that the escape of energetic molecules causes the skin to become warmer. Greater difficulty was experienced with **Item 14** (58%), with nearly a third of candidates choosing **C**. Even more problematical was **Item 15** (47%), all distractors being popular, especially **D**; the concept of thermal capacity was not very secure for many taking this paper. In **Item 16** (80%), option **C** attracted 14% of responses. The heat transfer **Item 17** (91%) was well answered, as was **Item 18** (84%), although in this 12% chose **D**. All three distractors worked well in **Item 19** (65%), a straightforward waves question. Although not many found **Item 20** (92%) very taxing, the same was not true of **Item 21** (only 56%) in which **C** and **B** were popular choices, suggesting that the ray diagrams had not been studied carefully.

Item 22 (63%) showed 23% opting for **D**, perhaps believing that the box contained an inverting prism, and failing to notice that the rays were labelled and had not been interchanged. With 80% facility, **Item 23** still confused some, of which most chose **A** – an image can be in focus without being at the principal focus of the lens. **Item 24** (92%) was not complicated, but in **Item 25** (54%) forgetting to take account of the reflection of the sound wave when an echo is formed caused a large number to select **D**. Worse answered was **Item 26** (40%) and it is possible that candidates took the four different methods as choices **A**, **B**, **C** and **D**, rather than looking for the *number* of correct responses. This type of item is used on occasion and candidates need to be prepared in case they come across it. **Items 27** (84%) and **28** (80%) worked well, as did **Items 29** (78%) and **30** (81%), but the more challenging electrical item, **Item 31** (46%), caused considerable difficulty – all distractors being effective, particularly **B**. Similarly **Item 32** (52%) taxed many, the clear favourite distractor here being **A**, showing apparent confusion between series and parallel connections. Another well answered item was **33** (94%) whereas the transformer and magnetic field **Items 34** (64%) and **35** (66%) were not tackled so effectively. The 77% facility of **Item 36** was very close to the target for this paper, and **Item 37** (83%) demonstrated a good knowledge of the particles involved in thermionic emission. **Item 38** (69%) worked well, **A** being the popular distractor, but responses to **Item 39** (22%) were very poor; all distractors were effective, and candidates were either unaware of the effect on the nucleus of β-emission, or could not apply this knowledge to the question. The final item, **Item 40** (87%) was another straightforward task for the majority.

Paper 0625/02

Paper 2 (Core)

General comments

Unlike this time last year, there were few candidates who produced excellent scripts in this examination. In fact, large numbers appeared to have a very poor understanding of even basic topics on the Core Syllabus. Only **Question 6** caused all candidates problems and, whilst it has to be admitted that part **(b)** of this question did require some clear thinking, part **(a)** should not have caused any problems, but it did. If this means that candidates are avoiding parts of the syllabus that are seen as "difficult", it is not a very wise strategy, because Paper 2 can contain questions from *any* part of the Core Syllabus. The real problem was that many candidates had weaknesses in most of the topics covered by this paper, and so scored poorly throughout the paper. It is understood that this paper is intended for those candidates not likely to obtain the higher grades, but any candidate hoping for the higher grades available with this option must expect to show a good grasp of most of the Core Syllabus.

Numerical work was usually competently carried out, where the candidate knew the underlying Physics. However, it needs pointing out that there were many instances where the candidate showed no working. This means that if the candidate puts the wrong answer, there is no way that the Examiner can award any marks at all for any correct steps taken on the way to the incorrect answer. This can be very costly to a candidate, and teachers are recommended to remind their candidates that it is important to show working in numerical parts of questions. Although most candidates showed good use of units, there were some candidates who were very weak in this respect. In a number of places within the paper, a mark was awarded specifically for using the correct unit. A good rule of thumb would be that if, on the question paper, an answer line in a numerical question does not have a unit printed on it, then a mark will be awarded for the correct unit when the candidate writes it in.

A final general point worth making is one that has been made before. Frequently the standard of handwriting is very poor. There is no penalty for this, nor for poor English, but if the Examiner cannot work out what the candidate is trying to say, as is sometimes the case, there is no possibility of marks being awarded. Candidates are foolish if they risk losing marks this way.

Comments on specific questions

Question 1

It was remarkable how many candidates could not cope with this question.

(a)(b) The basic skill of taking readings was lacking for many candidates, both the ability to interpret the scale correctly and the ability to extend the graph back to the axis in order to get the length with no load.

(c) Large numbers of candidates did not know how to find the extension, even those who had answers for **(a)** and **(b)**. The correct subtraction of their answers from **(a)** and **(b)** would have scored 2 marks.

Question 2

Generally, this question was well done by most candidates, even parts **(b)** and **(c)**, which required a little thought. Some better candidates unnecessarily tried to convert m/s to km/hour. If the conversion was correct, the unit mark was awarded. If part **(b)** was answered incorrectly, the mark for **(c)** was still awarded if it followed from the candidate's answer to **(b)**. It should be noted that answers to **(c)** such as "faster than" or "slower than" are not appropriate when describing a time.

Question 3

(a) This part was usually answered correctly.

(b) Most candidates realised the danger of the truck being blown over, but few could give a convincing reason.

Question 4

(a)(b) By no means all candidates could answer these two parts correctly. It was acceptable if the answers were just a little above the figures in the question, but lots of candidates multiplied/divided by 10, or for some reason doubled the figures.

(c)(d) The calculation of work and power are such basic parts of the syllabus that the marks for these two parts should have been certain for most candidates. They were not. As always, even an incorrect answer could score some marks, if steps of working were shown that merited it. Large numbers of candidates showed the units of work as Nm or N/m. Neither of these is correct.

Question 5

Answers to the whole of this question were most disappointing. It would seem that very few candidates had come across this arrangement, even in their textbooks. However, it would be hoped that some would realise that by far the most significant expansion would be that of the air in the flask. Most treated it as a water liquid-in-glass thermometer.

Question 6

This was a question where candidates' answers (or lack of them) suggested that they simply had not come across the reed relay/switch. Part **(a)** only required candidates to apply knowledge from elsewhere in the syllabus (currents in coils and magnetising of the reeds), but most could not do this. It is accepted that part **(b)** required careful thought, but few, even of the better candidates, were successful in doing this.

Question 7

This question was about as basic a question on ray optics as one could find. Hardly any candidate could answer it completely correctly. It has often been commented in the past that questions on ray optics are rarely well answered, and it is again recommended that candidates spend more time on this section of the syllabus.

(a) The filament of the lamp was clearly stated as being at the principal focus of the lens. This means that the rays leaving the lens should be parallel to the axis. The vast majority either showed the rays focusing to the right of the lens, at the same distance as the filament, or they simply failed to answer the question.

(b) Some candidates simply had no idea how to tackle this part. Of those who could answer it sensibly, many attempts were very good. The most common errors were:

Part **(i)** only marking the principal focus on the right of the lens (1 mark lost).

Part **(ii)** showing the refraction at one surface only, rather than at the mid-line or at both surfaces (1 mark lost).

Part **(iii)** not drawing the ray stated at all, but instead drawing the ray straight through the optical centre (1 mark lost).

Part **(iv)** failing to draw and label the image (i.e. a vertical line between the principal axis and the point of intersection of the rays) (1 mark lost). In the case where the candidate had used the ray straight through the optical centre, the two marks for the image could still be scored, where appropriate.

Question 8

(a) There were some reasonable attempts at this part, and most candidates scored at least some of the marks.

(b) The use of plotting compasses is a common way to illustrate magnetic fields, and many could answer this question. Common errors were to show the arrows either all pointing in the opposite directions to the correct ones, or to show them all going clockwise/anticlockwise round the magnet, or to show them all pointing away from the magnet. The directions of the arrows were each marked independently of the others.

Question 9

(a) Very few candidates failed to score full marks on this part.

(b)(i) A good proportion could draw this part correctly, although the general lack of care over presentation was very evident on many scripts. Wrong answers were usually due to missing out a component or showing things in parallel, but most candidates' attempts scored the mark.

(ii) Many candidates scored this mark. Those who did not, usually showed the voltmeter either in series with the other components or in parallel with the wrong component.

(iii) By no means all said that both lamps would light up. Some appeared to think that only the first lamp the current reached would light up.

(iv) "The current is the same throughout a series circuit" is not known by all candidates. Many thought that ammeter 2 would read 0.25A or 1.0A or 1.5A or 5.0A.

(v) Similar thinking to that in the **(iii)** comment above often applied, namely that somehow the current could still reach the other lamp and make it shine. Most, though, clearly understood that the current in the whole circuit simply ceases, although some generosity had to be shown in interpreting what they were trying to say. One common statement, which was not regarded as an acceptable answer was "The circuit is shorted out", or "There was a short circuit". The candidates who used such a phrase probably did mean that the circuit no longer worked, but the answer could not be awarded a mark. There are times where it is important to use the correct Physics language, and this is one.

Question 10

Both parts of this question were very well answered by large numbers of candidates. A few got tied up in unnecessary attempts to change the units, but this only incurred a 1 mark penalty if the underlying Physics was otherwise correct. Quite a few candidates attempted to give an answer without showing their working, running the risk mentioned earlier in this report. Similarly, quite a few failed to give units for density. Whilst most candidates knew the equation for density, a significant minority used D=V/M.

Question 11

(a) Most candidates identified cathode rays correctly, although a small number claimed that they were *positive* electrons for some reason. A few thought that they were rays of light.

(b) The source of the cathode rays was generally identified correctly.

(c) Most identified **D** as being coated with fluorescent material, but only a handful gave any convincing reason why it was so coated.

(d) The effect of the p.d. across **C** was not well known at all.

(e) The reason for the vacuum in the tube was not well known either, although many candidates made intelligent guesses, which were suitably rewarded. It seems that some think the vacuum being there is something to do with either preventing sound waves or stopping heat getting in or out.

Question 12

(a) Very few candidates could give an adequate definition of either half-life or background radiation. It really is important that candidates come to grips with definitions such as these, because such inability usually means that candidates do not understand enough to cope with other questions about the topic. It is worth pointing out to candidates that definitions starting with "It is when......." are rarely worth any marks. Teachers should not be afraid to insist that their candidates learn properly the basic definitions, which provide the building blocks of Physics. An interesting misunderstanding of background radiation was that it is radiation from the back of the source.

(b) This was a slightly unusual application of the decay curve, but a candidate who had learned about radioactive decay should have been able to cope with it perfectly well if he/she simply followed the steps given in the question, which guided candidates through the process without them having to think too much. Candidates who had learned the topic properly had no trouble with this question and scored well on it. However, there were far too many who had only a skimpy understanding, if any at all, and they tended to panic, and scored badly.

The sequence goes like this:

(i) Background count-rate and combined count-rate are both given – subtract to get source count-rate.

(ii) 1. Divide by 2 to get source count-rate after one half-life.

2. Add background to get reading on detector.

(iii) Use this reading to find value from graph.

(iv) Background is always there, even when count from source is negligible.

(v) A few scored both marks, but rather more got one mark, either for showing a steeper initial curve or for levelling the curve out at 25. Larger numbers still scored neither mark. A very large proportion ignored the instruction to answer part **(v)** on Fig. 12.1, but instead drew their own curves in the space below the question. It was virtually impossible to score either of the marks for **(v)** on such a graph.

Clearly, in many cases, the study of radioactive decay needed to be given a lot of additional attention.

Paper 0625/03

Paper 3

General comments

Many candidates appeared to find the paper more difficult than the corresponding candidates did on last year's paper. This may have been that the entry was less well prepared or that a greater proportion of less able candidates were entered. Whatever the reasons, the majority found **Questions 2**, **10** and **11** very difficult and so the mean marks on these three questions was very low.

As in previous examinations any questions involving accounts of experiments scored poorly. In spite of trying to lead candidates through bit by bit, most insisted on writing down theory and/or how to work out the result when the questions were asking for a list of the readings which needed to be taken. This could have been that candidates grasp of scientific terms in English was not good enough, (there was more evidence to suggest this was the case this year) or candidates did not spend long enough reading the questions carefully and then attempting to answer exactly what had been asked, rather than writing down everything they knew on the topic.

Calculations were on the whole satisfactory, but here also standards appeared to have declined somewhat. There were many more missing or wrong units than usual. However, only a small proportion failed to show any working. Whilst this scores full marks for correct answers with correct units, it scores no marks if the answer is wrong, whereas the use of a correct equation followed by a wrong answer will always attract some credit.

Quality of handwriting is not normally a problem, but in a number of scripts Examiners had a real problem in trying to decipher what had been written. Often these were candidates who wrote huge amounts, often between the lines or down the page side or continued at the bottom or on the blank page at the rear of the paper. It should be stressed to all candidates that brief, to the point answers are likely to score best. The number of lines for each part of a question is a clear indication of the length of answer required, as are the number of marks allocated.

Comments on specific questions

Section A

Question 1

(a) Clear statements for weight as the force of gravity on a mass were rare but most had the correct idea and scored the mark. The majority gave mass/volume for density which scored the mark.

(b)(i) All manner of wrong or partly correct answers were given for this simple procedure. All that was required was to hang the mass from the spring balance, take a reading in N and divide the reading by 10 to give the mass in kg.

(ii) Most realised that the volume was required, but clear descriptions were often lacking.

(c)(i) Generally correct.

(iii) A very large majority worked out the correct answer. A considerable number of incorrect units were seen.

Answers: **(c)(i)** 2 N, **(iii)** 4 m/s^2.

Question 2

(a) Very poorly answered with forces and moments regularly confused. Clear statements of the equality of opposing moments and opposing forces were rare.

(b) Generally well done. An approach based on moments was usually successful.

(c) Very few candidates scored any marks on this difficult part of the question. Most just reversed the weight of the ruler and wrote 1.5 N upwards. Those who took moments about the 20 cm point on the ruler had little difficulty in getting the correct answer.

Answer: **(c)** 0.5 N downwards.

Question 3

(a) The most common mistake was to just multiply depth by density. Another error seen was to use the correct formula but to be careless with the arithmetic and end up with either one too many or one too few zeros in the answer.

(b) Most used the correct formula, but a common error was in transposing it.

(c) A very high proportion scored both marks here for potential energy changing into kinetic energy, although a number managed to give the reverse change and others spoilt a correct answer by adding a chain of other changes.

Answers: **(a)** 20 000 Pa; **(b)** 0.0025 m^2.

Question 4

(a) This was quite the worst answered part of a question on the paper, with only a handful scoring all four marks. Attempts were so poor that a significant number managed to ignore the stopwatch and did no timing whatsoever. Large numbers did not answer the question by concentrating on the theory of the determination. Equally large numbers took temperature readings before, during and after the determination which were of no value. The majority started the timing at the instant the heater was switched on and equally large numbers took the time to melt all the ice. Almost all wanted to take the mass of the ice before and after the heating instead of concentrating on the mass of the water collected in the beaker in a recorded time when the process was up and running. A number wanted to measure the power of the heater in spite of the value being given on the diagram.

(b) Generally correctly answered although there were many who gave no time unit on the answer.

(c)(i) Far too many had heat lost to the atmosphere.

(ii) A wide variety of answers in terms of working at low temperatures were reluctantly accepted. A large number lagged the beaker which was quite useless.

Answer: **(b)** 680 s.

Question 5

(a)(i) Almost all gave random motion as a correct answer.

(ii) Almost all understood that pressure was due to molecular collisions on the wall.

(b)(i) Only a few incorrect answers.

(ii) Very few incorrect answers.

(c)(i) Quite a number of candidates misread the question as comparing gases and liquids, otherwise very well answered by the majority.

(ii) Apart from the same misreading as in **(i)** this was also well answered by the majority.

Question 6

(a) The majority scored the mark for the use of the word *reflection*.

(b) There were many giving 200 Hz and 800 Hz but the majority gave the correct 400 Hz.

(c) A surprisingly large number could not transpose the formula correctly and so lost a mark.

(d) Most had some idea but could not express themselves sufficiently well to score the mark. The mark required a vibration/oscillation along the line of travel of the wave, a mark that few scored.

Answer: **(c)** 0.83 m.

Question 7

(a)(i) Less than half the candidates scored both marks. Large numbers continued the rays behind the mirror converging to the image point.

(ii) Generally well answered but a number of wrong answers such as real and inverted were common.

(b)(i) Well done by most candidates even when **(a)(i)** was wrong. However, there were the usual random wrong rays generally ending in an “image” to the right of the lens.

(ii) If the image was in the correct place the eye was usually correctly to the right of the lens. A carry forward error for an image to the right of the lens was not allowed.

Question 8

(a) Few candidates gave a correct explanation in terms of an area where there was a force on a charge.

(b) Fully correct answers were in the minority though many managed one mark for the direction. A significant number of candidates made no attempt whilst others had curved lines in the centre of the plates.

(c) The majority of candidates scored both marks. The main errors were incorrect transposition of the formula, arithmetic errors and failing to give a correct unit.

(d) Mostly correct with a correct unit.

Answers: **(c)** 0.002 A; **(d)** 120 J.

Question 9

(a) At least half drew the correct shape and added 2 correct inputs and 1 correct output. Considerable numbers drew the shape of the AND gate, others drew only one input or failed to label the inputs and output.

(b)(i)(ii) As expected many had one input high and one input low. The majority understood this well and so scored the mark.

(c)(i) Some candidates did not know the action of the NOR gate or the NAND gate and so scored no marks. The majority had no difficulty in scoring both marks.

(ii) Mostly correct; some also gave excellent unnecessary explanations.

Question 10

(a) The answers were significantly poorer than those for similar questions in the past. In particular a huge number of scripts had the classic mistakes of current being induced in the core by the primary coil and then passing through the core to the secondary coil. Answers starting along this path rarely scored any of the 5 marks. Many others answered the question without any mention of a magnetic field which was almost as disastrous. Clear statements that an alternating current in the primary coil induces an alternating/constantly changing magnetic field in the core were rare. Hardly any stated that the main function of the core was to transmit the changing magnetic field to the secondary coil. The part played by the secondary coil was slightly better known but again here clear statements that the magnetic field cut the coil and induced a current/emf were not commonly seen.

(b) Large numbers got this wrong or gave no answer. A significant number had the secondary turns less than the primary turns.

(c) The mistake in **(a)** of current running through the core to the secondary coil produced a further problem here with a mistaken belief that the break in the core prevented the current passing to the secondary coil.

(d) Less than half used the correct formula with the majority trying to use a corruption of the turns ratio formula. Where the correct formula was used various transposition errors gave the wrong answer. Quite a number made no attempt at all.

Answer: **(d)** 0.2 A.

Question 11

This question was rather different than others in previous papers, which have generally tested the effect of a magnetic field, and so confusion reigned supreme. It should have been easier than the case of the magnetic field as it avoids the deflection in a third perpendicular direction. However, so many confused this with magnetic deflection that marks were bound to be very low.

(a) Most diagrams were very poor and so marks were low.

(b) The many answers in terms of the theory of the experiment were useless. Candidates simply did not say that readings/observations of the detector had to be taken in at least three places, near the positive plate, in the centre and near the negative plate. So many answers assumed that a stream of particles could be seen bending towards the positive plate.

(c) To simply state, as so many did, that the particles were deflected to the positive plate was not an acceptable answer to this question. A reference to a higher reading or spot of light on a screen near the positive plate was expected.

(d) This mark was widely scored. Many lost the mark because they gave a statement rather than an explanation, although it was sometimes possible to award the mark from information given in the other parts.

Paper 0625/04
Coursework

General comments

Once again, the candidates at the small number of Centres involved in coursework were given many opportunities to demonstrate their practical skills using a varied range of tasks from different areas of the syllabus. Clearly, a large amount of good work has been completed by teachers and candidates. All of the samples were well organised and were clearly annotated with marks and comments, which was helpful during the moderation process. The assessment criteria were successfully applied by the Centres and the marks awarded to candidates did not require adjustment by the Moderators.

Paper 0625/05
Practical Test

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques. These include

- graph plotting
- tabulation of readings
- manipulation of data to obtain results
- drawing conclusions
- dealing with possible sources of error
- control of variables
- accurate measurements
- choice of the most effective way to use the equipment provided.

The general level of competence shown by the candidates was satisfactory and very few candidates failed to attempt all sections of each of the questions. There was no evidence of candidates suffering from lack of time. Many candidates dealt well with the range of practical skills tested. Each question differentiated in its own way. Many candidates showed evidence of preparation for all the different types of question in the examination but there was evidence that some candidates had little or no personal experience of practical work particularly in the optics question.

Comments on specific questions

Question 1

(a)-(d) Most candidates took the readings carefully and accurately and completed the table with sensible θ values and correct units (g and ^{o}).

(e) Many candidates realised that θ is not directly proportional to m and most explained that by commenting that as m increased θ decreased. Other correct explanations were also seen and gained the marks.

(f)-(g) Most candidates very sensibly drew diagrams here to show their answers. Many were able to show that the protractor was placed so that the 0 – 180 line was exactly at bench level and that the end of the rule was at the centre of that line. For the next part, many candidates correctly suggested an additional rule at the far end of the of the metre rule in order to measure the height of the end of the metre rule above the bench. The final mark was often lost, however, as candidates did not show that the rule was either at right angles to the bench or clamped in position.

Question 2

(a)-(g) The majority of candidates recorded the currents and voltages correctly with current values in amps, voltage values in volts and resistance values in ohms. Also, the current and voltage values were usually given to at least 1 dp. Full marks for R were awarded if the values were arithmetically correct, all to 2 or 3 sf, and the values correct in relation to each other (within a reasonable tolerance). Many candidates scored most of the available marks. The most common cause of a lost mark was inconsistency in the number of significant figures to which the R values were recorded. Less common was a range of resistance values that showed that the candidate had not followed the instructions.

(h) Few candidates gained full marks for the circuit diagram. A surprisingly high number did not draw the correct symbol for the resistors as asked in the question. Symbols often seen were variable resistors, lamps, voltmeters and simply connecting leads. The better candidates were able to draw in the connection from **A** to **D** and a lead joining the ammeter to **C**. A few very good candidates correctly interpreted the set up and converted the diagram given on the question paper into a formal circuit diagram.

Question 3

(a)-(g) Full marks here were awarded to candidates who recorded all the temperatures showing decreasing temperatures. Some candidates did not complete the column headings in the table by inserting the units for time (s) and temperature (^{o}C).

The graph was generally accurately plotted with the temperature scale labelled but a suitable temperature scale using at least half of the available grid was rarely seen. Few candidates realised that a false origin would enable them to construct a scale that makes full use of the available grid. A significant number of candidates lost marks since their lines were too thick or they drew a poorly judged best-fit curve. Candidates should draw a best-fit curve that follows the trend of the plots rather than a line that attempts to visit each plot.

(h) Many candidates were able to make suggestions for improvement such as using a lid, insulating the bottom of the beaker, using the same volume of water in each beaker or other sensible approaches. However, some candidates apparently did not read the question and wrote theoretically about the causes of the temperature fall.

Question 4

(a)-(f),(h) Many candidates seemed to understand what was required here and were able to draw clear, accurate diagrams as instructed. Some lost marks because their lines were very untidy or too thick. In particular the reflected rays drawn in should have all come from a single point where the incident ray meets the normal at the mirror. To obtain good results in this type of experiment it is good practice to place the pins far apart. Candidates who placed their pins less than 5 cm apart lost marks. Some candidates appeared to have no experience of this type of experiment and drew seemingly random lines.

(g)-(h) The *r* values should have been 45°, 27° and 18°. Candidates who obtained these readings to within $\pm$ 2° were rewarded with accuracy marks here.

(i) Only the best candidates were able to suggest causes of inaccuracy (e.g. the thickness of the mirror or the thickness of the pins). The question read 'In spite of carrying out this experiment with care…'. However, many candidates chose to ignore this and effectively wrote that the causes of inaccuracy were carelessness.

Paper 0625/06
Alternative to Practical

General comments

The aim of the examination is to enable candidates to display their knowledge and understanding of practical physics techniques. These include:

- graph plotting
- tabulation of readings
- manipulation of data to obtain results
- drawing conclusions
- dealing with possible sources or error
- control of variables
- accurate measurements
- choice of most suitable apparatus.

It is assumed that, as far as is possible, the IGCSE course will be taught so that candidates undertake regular practical work as an integral part of their study of Physics. This examination should not be seen as suggesting that the course can be fully and effectively taught without practical work.

Clearly, some of the skills involved in practical work can be practiced without doing experiments – graph plotting, tabulation of readings, etc. However, there are parts of this examination in which the candidates are effectively being asked to answer from their own practical experience.

The answers given by some candidates in this examination, point to a lack of practical Physics experience.

Some candidates have a good overall understanding of what is required, backed by personal practical experience and therefore score high marks. Others, obtaining lower marks, appear to have limited experience. The comments on individual questions highlight the sections in which candidates often showed lack of practical experience or awareness of the significance of practical procedures that they may have encountered.

Almost without exception candidates attempted all the questions. The examination appeared to be accessible to the candidates and there was no mark that proved unobtainable.

Comments on specific questions

Question 1

(a) Most candidates completed the table with correct units (g and ^{o}).

(b) Many candidates realised that θ is not directly proportionate to *m* and most explained that by commenting that as *m* increased θ decreased. Other correct explanations were also seen and gained the marks.

(c)(d) Most candidates very sensibly drew diagrams here to show their answers. Many were able to show that the protractor was placed so that the 0 – 180º line was exactly at bench level and that the end of the rule was at the centre of that line. For the next part, many candidates correctly suggested an additional rule at the far end of the metre rule in order to measure the height of the end of the metre rule above the bench. Other attempts showed a lack of practical experience with candidates giving theoretical answers related to Hooke's Law and the spring.

Question 2

(a) Few candidates gained full marks for the circuit diagram. A surprisingly high number did not draw the correct symbol for the resistors as asked in the question. Symbols often seen were variable resistors, lamps, voltmeters and simply connecting leads. The better candidates were able to draw in the connection from **A** to **D** and a lead joining the ammeter to **C**. A few very good candidates correctly interpreted the set up and converted the diagram given on the question paper into a formal circuit diagram.

(b) The majority of candidates recorded the units correctly with current in amps, voltage in volts and resistance in ohms. Full marks for *R* were awarded if the values were arithmetically correct, all to either two or three significant figures. The most common cause of a lost mark was inconsistency in the number of significant figures to which the *R* values were recorded.

(c) Confident candidates were able to interpret the circuit from the diagram and realise that adding the results from **(b)(i)** and **(ii)** gave the resistance of the whole wire.

Question 3

(a) Most candidates inserted the correct units (*t*/s and θ /^{o}C).

(b)(c) The graph was generally accurately plotted with the temperature scale labelled. However many candidates ignored the instruction to start the temperature scale at 40^{o}C and therefore lost a mark. A significant number of candidates lost marks since their lines were too thick or they drew a poorly judged best fit curve. Candidates should draw a best fit curve that follows the trend of the plots rather than a line that attempts to visit each plot.

(d) Many candidates were able to make suggestions for improvement such as using a lid, insulating the bottom of the beaker, using the same volume of water in each beaker or other sensible approaches. However, some candidates apparently did not read the question and wrote theoretically about the causes of the temperature fall.

Question 4

(a)-(d) Many candidates seemed to understand what was required here and were able to draw clear accurate diagrams as instructed. Most measured the distance *x* correctly at 10.0 cm + 0.1 cm (few neglected to include the unit). Also most read the angle of incidence correctly at 27^o (+2^o). A minority of candidates clearly had little or no experience of the type of experiment and drew lines that had little relation to the instructions. Since this is, in a sense, a practical exercise a good standard of line drawing is expected with candidates displaying care and attention to detail.

(e) Many candidates calculated the ratio correctly but many lost a mark by not giving their answer to two or three significant figures or wrongly including a unit.

(f) Only those candidates familiar with this type of experiment realised that one pin would mark the incident ray close to the mirror and the other two pins would be placed some distance apart (5 cm minimum was allowed) on the reflected ray.

Question 5

(a) Many candidates correctly underlined all three of the suggested variables.

(b) Many candidates scored the available marks here by underlining the second and third suggested variables.

(c) Candidates familiar with the experiment confidently wrote about taking the time for a number of oscillations and then dividing the time by the number of oscillations. Others wrote vaguely about ‘techniques’ not related to this experiment.