RECOGNISING ACHIEVEMENT

GCE

Physics A

Advanced GCE **H558**

Advanced Subsidiary GCE **H158**

Report on the Units

June 2009

HX58/MS/R/09

Oxford Cambridge and RSA Examinations

This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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CONTENTS

Advanced GCE Physics A (H558)

Advanced Subsidiary GCE Physics (H158)

REPORTS ON THE UNITS

Unit/Content	Page
Chief Examiner's Report	1
G481 Mechanics	2
G482 Electrons, Waves & Photons	7
G483/01 Practical Skills in Physics 1	10
Grade Thresholds	14

Chief Examiner's Report

The AS entry for the new Physics A H158 specification was close to twelve thousand candidates. The examination papers for the June 2009 session were comparable in demand to the legacy papers in previous sessions. The written papers for G481 and G482 differentiated well between candidates of all abilities and produced a good spread of marks. All the questions on the papers were accessible to the candidates. It was clear that most Centres had adequately prepared the candidates for the complexities of this new specification. Most Centres demonstrated a good understanding of the marking schemes for the practical tasks for the unit G483. It is good to report that overall, the internal assessment and moderation of the practical tasks was robust and consistent, with about 75% of the Centres marking the tasks within tolerance.

Experienced teams of examiners provided accurate and efficient marking. Similarly, reliable teams of moderators carefully scrutinised the Centre-based assessment of the practical tasks and provided useful feedback and advice to foster good practice in all our Centres.

On-screen marking of the G481 and G482 papers allowed analysis of the performance of papers at a question-by-question level that was impossible before. The reports on G481 and G482 reflect this detailed analysis.

The report for each unit of the June 2009 examination is given below.

G481 Mechanics

General comments

The marks for this paper ranged from 0 to 60 and the modal mark was 32. It was encouraging to see that Centres and candidates had taken on board the significant comments from the January 2009 paper. Most candidates managed to reach the end of the paper in the time allowed. It seemed that more candidates were aware of the 'one mark per minute' rule for this paper. As with the previous paper, a small number of candidates were inadequately prepared for the complexities of this paper. Characteristically, such candidates either attempted the occasional question or wrote answers that lacked in both coherence and depth.

It is worth reminding Centres and candidates again that all scripts are electronically scanned before being marked by examiners. Most candidates wrote their answers within the scanned zones for each question. As before, the legibility of candidates remains a concern with hurriedly written numbers and too many basic scientific terms spelt incorrectly. It is sad when the candidates themselves cannot recognise their own numbers when solving problems. Candidates are reminded again that there are two marks available in this paper for including two technical words and spelling them correctly. Candidates need to focus both on their physics and on spellings when answering questions signposted by the pencil icon. It is vital that candidates steer away from using abbreviations. Most candidates showed a decent understanding of significant figures and rounding up numbers. A small number of candidates lost easy marks by incorrectly truncating their answers; for example, 373.6 km became 373 km.

A disappointing number of candidates failed to take advantage of the information given in the Data, Formulae and Relationships booklet. This booklet is an aid memoir to definitions. Surprisingly, too many candidates muddled up the definitions in this paper and consequently missed the opportunity of gaining some easy marks. A small cohort of candidates did not use this booklet and misquoted equations; for example, $F = m/a$ and $s = ut + at^2$. Rearranging equations remains a mammoth task for some candidates. Candidates who struggle with basic algebra can maximise their marks in analytical questions by selecting the appropriate equation and then directly substituting the values into the equation. All candidates need to have a better understanding of the command terms, especially 'state' and 'define'.

Comments on Individual Questions

Question One

Most candidates made a good start by scoring more than four marks in this opening question

The majority of candidates demonstrated a good understanding of the terms *distance* and *displacement* in **(a)**. The most popular similarity identified was that both quantities have the same unit. Most candidates identified displacement as the quantity having direction. A small number of candidates wrote about '*direct and indirect distances*' in **(a)(ii)** and consequently were unsuccessful in picking up some easy marks.

The majority of the candidates did well to determine the time taken by the aircraft to travel from **A** to **B** in **(b)(i)**. The rearranging of the simple speed equation was good and there were no major problems with mixing up units. A few candidates inevitably lost the mark by either writing down

$$\text{time} = \frac{360}{170} = 2.1 \text{ s}$$

or determining the time taken for the journey from **A** to **C**. The majority of candidates showed good understanding of the vector triangle in **(b)(ii)** by scoring full marks. Most of the answers were via Pythagoras' theorem but some candidates did opt for a scale drawing. A few candidates going down the route of a scale drawing lost a mark for either inappropriate choice of scale or incorrectly measuring the length of the hypotenuse. It was clear from the amount of writing in **(b)(ii)** that some candidates were spending a disproportionate amount of time on this question by scribbling down six or more steps for the calculation of displacement.

Question two

This question produced a range of marks with most candidates scoring more than four marks.

The majority of candidates gave succinct answers in **(a)**. Most candidates recognised that the gradient of the graph was the acceleration in **(a)(i)**. The mark was being awarded for the correct physics and correctly spelling of the term 'gradient'. Inevitably, some candidates gave answers in terms of an equation or used words other than 'gradient'. The marking scheme was diversified to accommodate a range of correct answers, including the use of the equation $a = \frac{v-u}{t}$. Most candidates knew that displacement was the area under the graph in **(a)(ii)**. A few candidates wasted valuable time by explaining how one of the equations of motion could be used to determine the displacement.

About half of the candidates managed to secure either one or two marks for the proof in **(b)**. The easiest bit of the proof was the '*ut*' element of the equation. About a fifth of the candidates scored full marks by logically ploughing through the physics to explain the origin of the '$\frac{1}{2}at^2$' component of the equation. About one in five candidates decided to skip this question.

The majority of the candidates could calculate the acceleration of free fall in **(c)(i)** by using the equation of motion given in the previous question. The most common mistake is depicted below where candidates swayed between constant velocity and accelerated motion:

$$\text{speed} = \frac{32}{2.8} = 11.4 \text{ m s}^{-1}$$

$$\text{acceleration} = \frac{\Delta v}{\Delta t} = \frac{11.4}{2.8} = 4.08 \text{ m s}^{-2}$$

In **(c)(ii)**, most candidates recognised that the acceleration of free fall was less due to air resistance. However, a disappointing number of candidates focussed on the precision of the measuring instruments. Other misguided suggestions were that the '*stone did not fall vertically because of wind*' and '*the building must have been taller than 32 m*'.

Question three

The modal range for this question was three to four marks, with a disappointing number of candidates scoring low marks in the descriptive question **(a)**.

There was a good range of marks for **(a)** with all candidates having a stab at the question. The journey of the skydiver was split into three stages. Most candidates managed to pick up two marks for the final stage of terminal velocity. Candidates were aware that '*net force = 0*' and the skydiver had '*zero acceleration'*. Sadly, the answers for the first and second stages of the journey lacked robustness and were riddled with misconceptions. Low-scoring candidates were mixing up quantities such as energy with acceleration. A disappointing number of candidates thought that the '*initial acceleration of the skydiver was zero until gravity suddenly took over*'. In most descriptions it was not clear what the candidates meant by '*gravity*'. Sometimes it meant the weight of the skydiver and at times even the acceleration of free fall *g.* Some candidates made copious reference to an '*upward force on the skydiver'* without mentioning drag or air resistance. Candidates lost valuable marks in this question because they wrote conflicting answers. Such candidates could have done better by writing down their well-considered answers as bullet points.

Only the high-grade candidates understood what was required in **(b)**. The answer had to be a form of energy and answers in terms '*friction*' could not be allowed. A disappointing number of candidates thought that the '*potential energy was being changed into kinetic energy*'. The correct answer was of course heat or thermal energy.

One of the toughest questions on the paper was **(c)**. Only 40% of the candidates picked up either one or two marks. The majority of the candidates mentioned '*that all objects according to Galileo and Newton have the same motion under gravity*' and as such, there would be no change to the shape of the velocity against time graph. Many candidates thought that the initial acceleration was going to be greater because of the greater force acting on the skydiver. Sadly, there were too many misconceptions in this question.

Question four

This question produced a range of marks with most candidates scoring above four marks. The main weakness of candidates was lack of accurate description of definitions. Sadly, too many were defeated by the demands of **(e)(iii)**.

In **(a)**, the majority of the candidates could not precisely define work done by a force. Examiners decided that a definition such as '*force times distance*' was unsatisfactory because such a statement could have been a definition for a couple or a moment. Work done is associated with an object or a force 'moving' and this is something that most scripts lacked. A few candidates defined the joule and consequently scored nothing.

The majority of the candidates correctly defined power in **(b)**. A small number of candidates spoilt their answers by defining power as '*the rate of work done per unit time'*. A few candidates defined power as '*current* × *voltage'*. A few desperate candidates went a step too far by suggesting that ' $p = F / A$; *power = force/area'*.

In **(c)**, the majority of candidates appreciated that friction or thermal losses were responsible for a mechanical device being inefficient.

Most candidates were successful with **(d)**. The majority of the candidates correctly calculated the change in the kinetic energy of car in **(d)(i)**. A small number of candidates either forgot to square the speed of the car or subtracted '$\frac{1}{2}\times 810\times 0^2 = 405$ J' from the initial kinetic energy. Most of the candidates picked up the one mark available in **(d)(ii)**.

About 14% of the candidates decided to omit **(d)(iii)**. This last part of the question provided good discrimination for the high-grade candidates, with about one in five candidates picking up two or more marks.

Question five

More than half of the candidates scored six or more marks for this question.

Most candidates made a good start with **(a)(i)** by correctly positioning the arrows for the weight and the normal contact force on **Fig. 5.1**. It was good to see that most candidates were careful with both the location and direction of the arrows, however, some candidates would have benefited from using a sharp pencil and a ruler. Only the high-grade candidates managed to access the one mark available for **(a)(ii)**. The most popular incorrect answers were $F = W\cos\theta$ and sadly, $W = Fx\cos\theta$.

A disappointing number of candidates defined 'moment of a force' in **(b)(i)**. Fortunately, candidates did well to spell '*clockwise*' in this question. A small number of candidates got all muddled up by mentioning clockwise and anticlockwise '*forces*'. As mentioned earlier in the introduction to this report, candidates are losing far too many easy marks by not correctly recalling definitions, rules and laws. In spite of problems with stating the principle of moments in the earlier part of the question, most candidates went on to score full marks for the value of the force *F* in **(b)(ii)**. Subsequently, the majority of candidates went on to correctly determine the pressure in **(b)(iii)**. A small number of candidates lost valuable marks by using 200 N instead of the calculated force *F* of 32 N. Most candidates realised that force *F* would increase and this led to greater pressure in **(b)(iv)**. This final question was a state and explain question; a large number did not give any reason for the increase in the pressure. Candidates must learn to read questions with care – perhaps underlining the key words might help them to gather more marks.

Question six

This question was devised for the high-grade candidates and hence the modal mark of two did not come as a surprise to the examiners.

It was good to see that most candidates secured two marks in **(a)** for the average speed of the spacecraft. Centres must make sure that their students are aware of the content of the Data, Formulae and Relationships booklet. The conversion 1 year $\approx 3.16 \times 10^6$ s is given on page 3 of this booklet. Sadly, too many candidates fretted about leap years, the number of weeks in one year, etc. Inevitably, a small number of candidates decided to divide the distance in metres travelled by the spacecraft by the journey time of 6.9 years.

The final section **(b)** proved too daunting for the majority of the candidates. About a quarter of the candidates wrote nothing. The high-grade candidates either used the equation of motion $v^2 = u^2 + 2as$ and $F = ma$ or $Fx = \frac{1}{2}mv^2$ to determine the magnitude of the force.

Question seven

The majority of candidates scored more than six marks for this question.

The majority of candidates made an excellent start with **(a)** by sketching the linear and plastic sections of the stress against strain graph. Examiners allowed a range of answers to reflect the material taught by Centres and variety of graphs shown in textbooks.

The vast majority of the candidates gave copper as the answer to **(b)**; the most popular erroneous response was '*jelly*'.

As indicated at the start of this report, candidates were poor with stating definitions and laws. The answers to both **(c)** and **(d)** lacked precision. The definition for ultimate tensile strength produced the most varied and bizarre responses, some of which are mentioned below:

- *UTS is the point before a material breaks.*
- *Tensile strength is the strength of a material – how strong it happens to be.*
- *The amount of force a material can take without plastically deforming or breaking.*
- *This is the stress value when the material starts to deform.*

Too many statements of Hooke's law failed to mention the proportionality between the applied force and the extension; instead, candidates mentioned '*extension gets bigger with more force*'. Answers in terms of stress and strain were not allowed. A small number of candidates added redundant statements, such as '*at constant temperature*'. It is sad that only about half of the candidates managed to recall Hooke's law in this AS-level paper.

Most candidates made an excellent start with **(e)(i)** and **(e)(ii)**. The equation $F = kx$ was correctly used to determine the maximum force provided by the spring. A small number of candidates selected the correct equation but then spoilt their answers by poor rearranging. About a fifth of the candidates got the wrong answer of 882 N by dividing the force constant of 75 N m^{-1} by the extension of 0.085 m. Most candidates had no problems using $F = ma$ to calculate the initial acceleration of the table tennis ball. The last question **(e)(iii)** was only accessible to the high-grade candidates. The maximum height of the ball ranged from a fraction of a millimetre to several kilometres. More than a quarter of the candidates omitted this final question but a third of the candidates managed to secure one mark for either selecting the equation for gravitational potential energy for the ball or elastic potential energy for the spring.

G482 Electrons, Waves & Photons

General comments

Candidates seemed to have sufficient time to complete the paper and weak candidates were able to find sufficient sections to attempt an answer to every question. Most questions clearly increased in difficulty from start to end and successfully differentiated between different abilities. However, a significant number of candidates failed to score some of the easier marks. The inaccurate use of a calculator was more frequent than expected, with some showing little appreciation of reasonable values, for example, huge currents through Christmas tree bulbs and ultra-slow electron speeds. Problems with transposition and powers of ten in calculations did take the gloss off some responses. Most candidates drew diagrams to illustrate their answers where required but many descriptive responses lacked structure and careful argument. The standard of grammar, spelling, and punctuation was often poor. This was especially noticeable in question 7.

Comments on Individual Questions

Question 1
Q1a Many answered well but others described rather than defined resistance or gave the resistivity equation. Definitions were occasionally given in terms of units which scored no marks.

Q1b Most candidates calculated the correct voltage but too many failed to convert from mA to A when calculating the resistance.

Q1c Most scored marks for inclusion of an ammeter and voltmeter but almost none had a circuit which allowed the supply to vary from 0 to 6 V. Many graphs started at the origin. An inverse proportionality was also often seen so few candidates gained both marks. There were too many attempts to explain the graph in terms of Ohm's law. Many answered correctly but a large number did not relate change of resistance to temperature. This question discriminated well between candidates of different ability.

Q1d A surprising number failed to achieve both marks for the first part of the question. Some could not visualise how the lamps were connected; attempts at the use of the parallel resistance formula often failed through numerical mistakes.

Question 2
Q2a Kirchhoff's law was usually known and written correctly.

Q2b Most candidates could add the resistances correctly. The common error was to ignore the polarity of the 2 e.m.f.s and add the e.m.f of the battery to that of the charger giving 21.6 V. An initial charging current of 27 A then gained full marks by error carried forward.

Q2c Well done by most although some omitted 60, or 3600 from the calculation losing one mark. Some used 12V instead of 14 V to find the energy supplied by the battery charger. Considerable difficulty was encountered in the last part but it was good to see the more able candidates taking the ratio of 'lost volts' to charger voltage. This was a good discriminator.

Question 3
Q3a The common error was to use 24 V to calculate the current in (i) as 0.12 A. Otherwise the remaining calculations were done well.

Q3b This was well answered although weaker candidates were confused between the fixed resistor and the thermistor. Most realised that the voltage halved and with the same current the resistances must be the same.

Q3c Most drew correct I-V graphs for the resistor but the thermistor graph was not well understood, being the weakest aspect of the question.

Question 4
Q4a The first two parts were generally well answered. The experiment was not often clearly explained with few describing the rise and fall of intensity as rotation occurred. Many wandered into light polarisation, particularly in the use of the word Polaroid, and a few came up with oven and water references. It was very rare to see anyone use the natural polarisation of the emitted wave and the orientation of the receiver to show this.

Q4b Most candidates could state the amplitude of the motion but there were some careless answers of 3mm; f = 1/T was known but many used the period as 4 s instead of 4 ms. In the sketch graph of the next part most increased the amplitude maintaining the same period. Knowledge of Intensity variation with amplitude was poor. The last part was not particularly well answered for a standard laboratory experiment, with some confusion between a microphone and a CRO. A significant number tried to describe the use of a tube and tuning fork to measure the speed of sound.

Question 5
Q5a The common errors were to describe a node as a minimum amplitude. Maximum amplitude was the correct favoured answer for an antinode, but maximum displacement featured too often.

Q5b Most realised that there was reflection at the pulley, but one mark was often lost by not discussing the effect of the interference of incident and reflected waves. The next two parts were answered well. The wave equation was well known, but quite a few answered 7200.

Q5c Many didn't appreciate that a numerical response was required for the marks in this question. It proved to be a good discrimination where strong candidates could calculate both the new velocity and new wavelength.

Question 6
Q6a Most candidates could find the grating element correctly and go on to show that sin θ was 0.19 but some stopped at this point. The use of n=300 in some responses was worrying. The more able candidates showed that if n was greater than 5 then sin θ was greater than 1, and there would be 2n+1 spots. Weaker candidates failed to account for the 11 spots.

Q6b Most candidates calculated the photon energy correctly but many struggled here with the added complication of power in mW.

Q6c Many stated the wave nature of the electron and mentioned the need for the wavelength to approximate the atomic spacing. Answers tended to stop after making these two points. Few explained correctly how rings were formed. Those who could make speed the subject of the de Broglie's equation invariably gave the correct answer. Too many could not rearrange the equation. Very few candidates then used the KE = eV equation to calculate the p.d. The most able achieved this; a good discriminator for the top grades.

Question 7

Q7a The gold leaf electroscope was by far the most popular choice of experiment. Although the use of UV lamp and a zinc cap was well known the starting point of a negatively charged electroscope was often not recalled; the most common error being the idea that the emission of electrons from the zinc caused the gold leaf of the electroscope to rise. Those who chose alternative methods were equally confused over details with many cross-bred photocells making an appearance. Where the experiment was described satisfactorily, the conclusion of how the PE effect was demonstrated by the experiment was often omitted. It was also not uncommon to find responses to part b appearing in this answer.

Q7b Good candidates who had a clear understanding of a difficult concept gained all five marks. Most were able to make several factual points about the photoelectric effect. In many cases however explanations and links between ideas were unclear. Also many gave definitions mixing threshold frequency and work function, for example. Some continued to describe the experiment in part a. Only a few appeared to be unfamiliar with the effect.

G483/01 Practical Skills in Physics 1

General Comments

This was the first time that this unit was offered for moderation. Any assessment of practical skills relies very much on the care and attention to detail that the individual Centres put into the process. In general Centres approached the organisation of the tasks well and candidates appear to have been suitably prepared. There were no major issues with the apparatus required to carry out the tasks. Centres are thanked for the valuable contribution that they have made in making this unit of assessment successful.

One of the purposes of the moderation process is to confirm the marks awarded by a Centre. It is thus very helpful where a Centre has annotated the script either to justify the award of a mark or to indicate why a mark has not been awarded. It was clear from the moderation process that the majority of Centres marked the tasks carefully and it was pleasing to see many helpful annotations.

Another purpose of the moderation process is to ensure consistency between Centres and thus it is essential that the mark schemes provided are followed. Centres are asked to use the marking boxes provided on the tasks so that the moderators are aware of which marks have been awarded. It was clear that the majority of larger Centres had carried out a ‘cross-moderation’ process. Where this does occur, it is important that the final agreed mark is indicated in red in the appropriate box.

Candidates should be reminded of the need to show all the steps clearly when carrying out calculations. In addition candidates should be encouraged to include greater detail in their answers to descriptive type questions, giving reasons where necessary. Often these type of questions at the end of the Qualitative Tasks and the Evaluative Tasks are ‘high demand’ questions and thus Centres should not credit trivial answers.

Centres are reminded that the only help to be given to candidates is clearly indicated in the ‘instructions for teachers’. Any help given must be recorded on the front of the appropriate task. Under no circumstances should help be given in the construction of the table of results, the graph or the analysis parts of the quantitative tasks.

Centres are advised to use the Practical Skills Handbook (available from the OCR website) to assist in both the preparation of candidates and the marking of the tasks.

Administration

The majority of Centres met the relevant deadlines and the samples were well organised. Moderators did find a number of arithmetic errors; the largest one resulted in a candidate’s mark increasing by 10 (ten) marks! It is good practice that Centres should check the adding up of the individual tasks and preferably find another person to check this process. There is a spreadsheet available on “interchange” to assist the process.

OCR has used a new system to select the samples this year. On the whole it has been efficient. It has relied on the email address of the Centre being correct. It has also produced some automated emails from the moderators. The system will continue to develop so as to improve the moderation process further. Centres should ensure that the marks are submitted to OCR and the moderator by 15th May. Small Centres should also submit all their candidates work in line with the moderation instructions directly to the moderator and not wait to hear from the moderator. Larger Centres should wait for the automated email from OCR.

It was very helpful where Centres enclosed with their paperwork any correspondence with OCR including copies of emails and coursework consultancies. Centres should also include a sample set of results together with any details of any modification to the tasks.

Finally it is essential the Centre Authentication Form is completed and sent to the moderator. Moderators had to ask a number of Centres to supply this form. Copies of this form are available from the OCR website.

Qualitative Tasks

It would appear that Task 1 was the most popular task this year. The mark scheme for Task 2 did not necessarily allow as much ‘error carried forward’ for weak candidates although there was no evidence that good candidates could not score highly on this task. This task has been modified for 2009/10.

Generally Centres marked these tasks accurately. The following points are worth noting for next year.

Where candidates are asked to describe an experiment, the description should include how the variables are to be manipulated as indicated in the additional guidance of the mark scheme. In task 1, B1.2 was a little generously marked; detailed methods are needed.

Where graphical work is requested in the Qualitative Tasks, candidates are not being assessed on the size of the graph or the labelling of the scales since this is assessed in the Quantitative Tasks. The graph may be used to judge the quality of an experiment. In addition, candidates may be assessed on their drawing of a straight line of best-fit or a smooth curve. Candidates who draw a straight line through a curved trend should be penalised. Likewise the drawing of ‘hairy’ lines should also be condoned. Further guidance is given in the Practical Skills Handbook.

The last part of each of the Qualitative Tasks requires candidates to describe and explain their observations using relevant knowledge and understanding of physics. This was again often generously marked. Centres should ensure that the mark scheme is carefully followed. Clear annotation as to where a mark is awarded should also be given.

Quantitative Tasks

Again Task 1 appeared to be most popular. In Task 3 a number of Centres used a different diameter wire and appropriately adapted the mark scheme.

Centres are able to help candidates in setting up the apparatus (as indicated in the mark schemes), any help given must be recorded in the box on the front of the Task. Under no circumstances may Centres assist candidates in the construction of graphs or in the analysis section.

Most candidates were able to set up the apparatus in the tasks without help. Centres that did provide help clearly indicated it; this was very helpful to the moderation process.

Results tables were generally well presented. The majority of candidates labelled the columns with both a quantity and the appropriate unit although weaker candidates often did not score this mark with the more complicated units. It is expected that there should be a distinguishing mark between the quantity and the unit. Indice notation should be encouraged.

All raw data should be included in a table of results and given consistently. Common errors in this part were to have inconsistent readings eg distances not measured to the nearest millimetre when using a metre rule or not to use a suitable full range. When significant figures are assessed in the table, each row should be checked and the column ticked if correct or the first incorrect value circled. A mixture of the number of significant figures is allowed.

Graphical work was generally done well. Weaker candidates often used less than half of the graph grid for their points. On the graph paper provided, it is expected that the points should span four large squares horizontally and six large squares vertically. Points were usually plotted accurately to the nearest half square. Often mis-plotted points were very obviously wrong; candidates should be encouraged to check points like this as they finish plotting graphs. The majority of candidates drew their line of best-fit with a fair balance of points.

Candidates will normally need to determine the gradient and/or the *y*-intercept of their line of best fit. It is expected that the gradient should be calculated from points on their best-fit line which are at least half the length of their line apart. Weaker candidates often lost marks either by using triangles that were too small or by working out $\Delta x/\Delta y$. Good candidates indicate clearly the points that they have used and show their calculation. Where candidates are not able to read off the *y*-intercept directly, it is expected that they should substitute a point on their line into the equation $y = mx + c$. In Task 3 often a false origin was used and this resulted in an incorrect *y*-intercept. Guidance is clearly given in the Practical Skills Handbook. Gradient/*y*-intercept values do not need units; ignore both incorrect units and significant figures at this stage.

Candidates are then required to use either their gradient or their *y*-intercept to determine another quantity. It is essential that candidates show their working. For C2.1, the first mark is given for equating the gradient or *y*-intercept correctly; the second mark determining a value for the quantity using their particular values for the gradient and/or *y*-intercept. At this stage candidates are not penalised for a power of ten error or indeed if a mistake has been made in the previous step. This year candidates were often not awarded the C2.2. unit mark because of the inconsistency in their units. The C2.2 marks will be awarded next year for a candidate who has used the gradient/*y*-intercept and given their answer to an appropriate number of significant figures and the second mark is awarded for the quantity being within a specified range with a consistent unit. It is at this stage that a power of ten error would be penalised. For example, a candidate determining the acceleration of free fall, *g*, the mark scheme may say allow 9.00 ms^{-2} to 11.0 ms^{-2}. If this was the case a candidate who calculated *g* correctly for C2.1 for two marks having arrived at a numerical answer correctly using the equation given, would score one mark for C2.2 for an answer of 970 ms^{-2} or 971 ms^{-2} (since there is a power of ten error but the number of significant figures in both cases is appropriate).

The final mark for the quantitative task (C2.3) is awarded for justifying the number of significant figures. The phrase “raw data” is not explicit enough; candidates should quote the quantities that have actually been used.

Evaluative Tasks

The Evaluative Tasks were where weak candidates had greatest difficulty; very similar to the previous practical examinations and coursework. There are a large number of high demand marks in these tasks and Centres should not give credit for weak or vague answers.

The initial part of the task requires candidates to determine percentage uncertainties. When marking this part, significant figures should not be penalised. In task 1 a very large number of candidates incorrectly used 0.01 s for Δt. Where candidates are asked to determine a percentage uncertainty in a quantity requiring the use of the gradient and/or *y*-intercept then the worst acceptable line should be drawn; candidates do not need to use error bars. In task 3 this was quite difficult, but it was very pleasing to see the most able candidates achieving this mark.

For C3.2, candidates were expected to make a relevant point regarding the scatter of points about the straight line of best-fit as well as compare their values in conjunction with the previously calculated uncertainties. This question has been changed for 2009/10 so as to guide the candidates more towards the expected answers.

For C4.1 and C4.2, weak candidates are often describing the procedure they followed. Some candidates wrote very little of substance. Good candidates scored well by describing relevant problems and suggesting specific ways to overcome them. Vague suggestions without explanation did not gain credit. In particular 'light gates' without explanation should not score; detail is needed. Centres should ensure that they follow the mark schemes carefully.

The last part of each Evaluative Task (C4.3) requires candidates to identify one source of uncertainty and indicate the likely effect that this uncertainty would have on the quantity determined. Candidates should use a step-by-step approach and include the effect on the gradient and/or *y*-intercept. It was pleasing to see good candidates gain this mark.

The Future

As Centres are aware the Tasks for 2009/10 were published in June 2009. Three tasks have been replaced for 2009/2010. The tasks that have been replaced may well be used again in future years so obviously must remain confidential. Qualitative Task 2 is to be used again but has been amended. One of the questions on the Evaluative tasks has also been altered to assist candidates in their answers.

The mark schemes for the tasks have also been revised and are published in September. It is hoped that they will be able to be applied more easily to the tasks. In particular, for the Qualitative Tasks and the Evaluative Tasks, Centres have some discretion on applying the marks for B1.2, C4.1 and C4.2 – good, detailed answers are required. Centres are welcome to seek further clarification from OCR.

Centres are always welcome to email OCR for clarification. There is also a coursework consultancy service available. It would be helpful if Centres could submit coursework consultancies as they mark the tasks and preferably by the end of the Spring term so that feedback can be given in good time before the 15th May deadline.

Finally last year's tasks, instructions and mark schemes continue to remain confidential.

Grade Thresholds

Advanced GCE Physics H158 H558
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
G481	Raw	60	44	39	34	29	25	0
	UMS	90	72	63	54	45	36	0
G482	Raw	100	64	56	49	42	35	0
	UMS	150	120	105	90	75	60	0
G483	Raw	40	32	29	26	23	21	0
	UMS	60	48	42	36	30	24	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
H158	300	240	210	180	150	120	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
H158	18.5	34.0	50.4	66.3	80.1	100	7588

7588 candidates aggregated this series

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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