GCE

Rewarding Learning

Chief Examiner's Report
Physics

Summer Series 2017

Foreward

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Education (GCE) in Physics for this series.

CCEA hopes that the Chief Examiner's and/or Principal Moderator's report(s) will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at www.ccea.org.uk.

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GCE PHYSICS

Chief Examiner's Report

General Observations

As was observed in previous series in the legacy specification, poor handwriting in written responses is still a difficulty, more so with online marking than paper marking. Candidates should be aware that they should score out and write fresh answers rather than overwriting numbers as it is impossible to decipher overwritten numbers when the paper has been scanned. Disorganised layout of working in unstructured calculations continues to create problems. Where the correct answer has not been achieved and examiners are trying to award credit for candidates working it can be difficult on those scripts where the working is unclear. Points on graphs should be clearly marked so that they can be identified after the scanning process.

Candidates should be reminded that while past papers and their mark schemes are useful tools they should not be reliant upon the mark schemes for learning answers. It is obvious in many cases that candidates are learning generic answers but are not applying their knowledge to the specific question asked and are missing subtleties. Evidence of careful reading and interpretation of the question is missing in many candidate's responses.

When performing calculations using given data it is expected that candidates should quote their answer to a suitable number of significant figures. While not doing so will not be penalised in every question it is expected as good practice and will, on occasion where relevant be penalised. Answers should also be given on the answer line rather than working out shown leading to an answer and the answer line left blank.

There was a general feeling from candidate's responses to questions on experimental technique and practical skills that candidates do not always have the specific practical experience necessary for them to have the complete understanding and knowledge that is expected at this level. Centres should be aware that by replacing practical work with videos and simulations they may be penalising their candidates. While these may be useful as supplemental teaching tools they should not replace practical activities.

Assessment Unit AS 1 Forces, Energy and Electricity

Candidates found this paper quite long and while there was little evidence of incompletion there were suggestions that candidates had little time to check over their work at the end. The increase in paper marks to 100 from the legacy specification has allowed for more of the specification to be examined. There were a number of unstructured calculations which challenged candidates but in marking most candidates have been awarded some credit in these. This is the first year of the specification and it would be the intention to ensure that in the future mark allocation and paper length is appropriate so that the slight lack of time is not an issue for candidates.

Q1 **(a)** This was very well answered by the majority of candidates.

(b) Many candidates did not define the unit in Part (i) and may have scored 1 mark out of the 2 available. Part (ii) was very well answered by most candidates.

Q2 **(a)** This was well answered. Almost all candidates used all three sets of values and averaged. Some averaged the values of current and voltage before calculating the resistance. While in some cases this may have given the same numerical answer it is incorrect procedure.

(b) Answers in Part (i) varied in terms of quality. Many candidates could correctly explain resistivity. Most showed adequate understanding of the term material property. In Part (ii) the majority of candidates scored at least 3 marks for calculating the resistivity. Beyond that success levels varied with a significant number of candidates using the new length with the original cross section area. There were some excellent answers from top level candidates.

Q3 **(a)** The principle of moments was well known by most candidates but common errors were leaving out 'sum of' or 'when in equilibrium'.

(b) Part (i) was well answered by those who read the question and realised that the system was not uniform. Part (ii) challenged many candidates and only a few could work through to obtain full marks on this. Difficulties arose with using 3 forces and the unknown distance.

Q4 **(a)** This was generally well answered. Some candidates did not square the base units of v correctly and a few confused the V for volume in density with speed, v, and cancelled these quantities.

(b) This was very well done by many candidates. In Part (i) answers to the nearest tablet were credited even though this introduced 7 significant figures. 10^n errors occurred in both parts on occasions.

Q5 **(a)** Some candidates gave very concise answers here and scored full marks while many others did not read the question properly and thus included a lot of extra information, often missing the key points. The most common emission was of the direction rather than the magnitude.

(b) Many candidates failed to recognise that this was not a case of uniformly accelerated motion and used equations of motion in both parts. In Part (i) few drew a tangent. Those who did usually went on to score full marks. In Part (ii) the area was often over estimated and the quality mark lost, despite a generous range in the mark scheme.

Q6 **(a)** This part was difficult in terms of marking due to the wide variety of methods of carrying out the experiment. Some candidates appeared to do nothing more than exchange the electromagnet and trap door with light gates and at times even had a combination of both. This was a case where it seemed unlikely that all candidates had performed the experiment themselves. Others gave clear explanations and were obviously familiar with the set up. Many could not explain how the procedure they were using related to the equation of motion used.

(b) This was well answered by some candidates. Most recognised that air resistance could be a factor. Others just described general inaccuracies that could either increase or decrease the value obtained for g.

Q7 **(a)** This was very well answered by most candidates. Almost all were able to calculate the correct height in Part (i) and most managed to calculate the difference in speed in Part (ii) although some subtracted the kinetic energy and then calculated a value for speed. A few used speeds such as the speed of sound in air or the speed of light as the speed the ball would have reached had it been dropped in a vacuum.

(b) Although few candidates scored full marks in this part it was quite well answered and most fell into expected standard errors. In Part (i) those who did not get to the correct answer had just errors in using the efficiency incorrectly. This also occurred in Part (ii) where many candidates scored 3 out of 5. Most candidates were given credit in Part (iii) for reasonable answers.

Q8 **(a)** Newton's laws were often inaccurate or incomplete. A significant number got all 3 correct but many others omitted key words.

(b) This was answered well by some candidates. Some did not make any reference to Newton's laws and answers were often repetitive; lengthy responses but only hitting one point. Many candidates did not answer what was asked in terms of the movement of the raft before and after the jump. Responses were often unstructured and lacked clarity.

Q9 **(a)** Many candidates scored both marks here. Some could not apply their knowledge of the experiment to the situation given and introduced extra sources of emf.

(b) This experiment is well known and descriptions were good. Commonly candidates scored 3 or 4 out of 5, failing to specify that at least 5 sets of readings were required or ignoring the negative gradient.

Q10 **(a)** This was very well answered by most candidates

(b) This was poorly answered. In Part (i) some candidates got the idea that the bulb would light at low temperatures but very few could explain why in terms of voltage. The calculation in Part (ii) was challenging and many candidates struggled. Few got to the correct answer, commonly 2 marks were awarded either for part working out the first half, an error carried forward into the second part of the calculation.

Q11 **(a)** Very few candidates scored both marks here. Most answered in terms of velocity rather than forces acting.

(b) This calculation was very well done by some candidates. Others struggled to separate the vertical and horizontal motion and a large number assumed that the ball would hit the net at the highest point of its motion. Most candidates added on the players height at the end and were given credit for this, whatever their final answer.

Q12 **(a)** This was well answered by most candidates although some appeared to have the correct answer but on closer inspection they had incorrect masses in their equation so were penalised.

(b) The explanation in Part (i) was usually quite well done although many candidates did not refer to the equation. Part (ii) was well done by many candidates.

Q13 This was poorly answered by many candidates but others had no problem gaining full marks. Some calculated the incorrect angle.

Assessment Unit AS 2 Waves, Photons and Astronomy

This paper was quite well received by candidates. Changes to the specification seem to have introduced concepts that are perhaps more mathematical with the result that candidates' performance has generally improved in this unit.

Q1 **(a)** This was well answered by most candidates. Almost all candidates had an acceptable explanation in Parts (i) and in (ii) most candidates scored at least 1 of the available 2 marks.

(b) The calculations in this part were well answered. In Part (i) some candidates divided by the incorrect wavelength. Most gained full credit in Parts (ii) and (iii); Candidates seemed well prepared for this new content of the specification.

(c) Very well answered by the majority of candidates.

Q2 **(a)** This calculation was well done by candidates. A number calculated frequency and didn't continue to find the wavelength.

(b) Some candidates worked methodically to achieve the correct answer here but a significant number could not successfully approach the calculation.

(c) Explanations were sometimes vague here and the majority of candidates did not score both marks.

Q3 **(a)** This part was poorly answered by many candidates. A few scored full marks in both parts but many gave answers that were irrelevant and showed lack of understanding of the concept.

(b) This was answered well by some candidates and poorly by others. Some candidates seemed familiar with the experimental set up while others used phrases that might suggest they had seen animations of the effect rather than the experiment. A significant number of candidates used the term wave-particle duality rather than the specific significance of this experiment.

(c) This was well done by most candidates although there were some incorrect conversions to nm.

Q4 **(a)** This was generally well answered although many candidates failed to state the number of sets of results that should be taken.

(b) The equation to calculate refractive index in Part (i) was known by almost all candidates. Some used the inverse of the gradient but the majority just used a point. A significant number of candidates took sin of the values on the axis. Parts (ii) and (iii) were well answered by most candidates.

(c) The majority of candidates scored 3 out of 4 in Part (i) with very few showing correct, if any, refraction as the ray entered the fibre. Part (ii) was quite well answered by most candidates although some described the general function of an endoscope.

Q5 **(a)** The ray diagram in Part (i) varied in quality between candidates. This was an unfamiliar lens question but many candidates were able to reach the correct answer. Answers from calculation only without any use of the scale diagram were not credited.

(b) This was poorly answered by many candidates. In Part (i) some reached the correct answer and a significant number used a positive v to only lose 1 mark. Part (ii) was answered well by most although there were commonly 10^n errors.

(c) This was quite well answered by most candidates although some did not give consistent answers to Parts (ii) and (iii) from their answer in Part (i). Part (iv) was not always explained well.

Q6 **(a)** This was quite well answered although a number of candidates did not mention the waves meeting or equivalent.

(b) Diagrams in Parts (i) and (ii) were generally well drawn although a significant number of candidates did not identify the modes correctly.

(c) This was quite poorly answered with most candidates describing a node but not an antinode. The question asked for the 'difference' which the majority of candidates ignored and merely stated definitions of each.

(d) This was well answered by most candidates although a common error was to divide the length of the tube by 4 to get the wavelength of the 1st mode of vibration. This led to a loss of just 1 mark.

Q7 **(a)** Detail and relevance of answers to this part varied. Very few candidates were credited full marks. Most commonly candidates omitted to explain what the path difference was in terms of the distances on the diagram.

(b) All three quantities in Part (i) were rarely correct in candidates' responses. There was a spread of errors affecting each quantity. Almost all candidates were credited in Part (ii) as it was awarded for whatever values they had in Part (i).

(c) A significant number of candidates were able to correctly answer Part (i). Many made error in determining d and there also confusion over what angle they should use. Part (ii) was well answered by most.

Assessment Unit AS 3 Practical Techniques and Data Analysis

Section A

The standard in this paper was generally high with most candidates scoring very well.

As a result of feedback from centres and observations during the marking process some minor adjustments will be made to this paper for future series. Timing of the practical activities will be adjusted to allow for a few minutes at the end as 'write up' time. Where it is not obvious and familiar, such as in timing oscillations experiments, candidates will be advised as to the number of repeats/readings that they should take. This means that these skills will not be repeatedly tested and candidates will not be disadvantaged by using the time to take unnecessary sets of readings.

Candidates should be aware that they should follow all directions on the paper and record results where indicated. When asked to outline experiments, candidates should ensure that their answers are clear and concise with sequence. The word 'reliable' in the stem of a question suggests that repeats and averaging is necessary. Candidates should be able to identify common relationships from their results and explain these both mathematically and in words.

There were a number of issues in centres where apparatus lists/set-up instructions had not been followed and this resulted in candidates having answers outside the range given in the markscheme. Where possible centres must set up as instructed to ensure that their candidates are not disadvantaged.

Q1 **(a)** This was well answered by the majority of candidates. Most scored full marks. A few omitted a quantity or measuring instrument.

(b) Results were often haphazardly laid out but were usually all there. The most common errors included not measuring l to the nearest mm and not repeating d values.

(c) This was well answered by most candidates using their results. 10^n errors were common.

Q2 **(a)** Diagrams varied in quality but most candidates got full credit.

(b) The majority of candidates took a reasonable set of results but a significant number measured the incorrect angle as the angle of refraction. Many candidates extended their table here to calculate sin i and sin r values.

(c) Many candidates here did not verify Snell's law, they calculated a value for refractive index instead. A significant number got full credit.

Q3 **(a)** This question was well answered by some candidates although others did not give the required detail. Some candidates were vague about the distances that were being measured.

(b) Answers were often very difficult to decipher as it was unclear what was being recorded, points or distances. Candidates were generally awarded marks here. The most common errors were only using one suspension point and not recording distances to the nearest mm.

(c) This was quite well done by most candidates but as in Part (b) it was sometimes difficult to follow candidates' working out.

Q4 **(a)** This was generally well answered with headings and units correct. Some candidates did not tabulate their results. Timings were usually for an appropriate number of oscillations and repeated and averaged.

(b) This was quite well answered by some candidates but others gave very vague responses and were not hitting the key points required.

(c) The value of k was generally correctly calculated though some candidates only did a single calculation.

Section B

The graph drawing and data analysis parts of this paper were generally well done by candidates but many struggled with the detail of improvement in experimental technique of a prescribed experiment on the specification. As in other papers, there are concerns that candidates do not have access to adequate practical opportunities.

Q1 Many candidates scored full marks in this questions. For those who lost marks, mistakes included reversal of the axis, incorrect labelling and incorrect scaling. A few candidates did not attempt to scale the kinetic energy axis at all, merely putting the values in the table on the major lines. Some changed the scale by a power of 10 part way along.

Q2 **(a)** Gradients were generally calculated well by most candidates and the majority could determine the unit correctly.

(b) Extreme lines in Part (i) were drawn well by some candidates but others were much too far away from the points. Candidates should be reminded that the line should be an extreme fit for the plotted points and should still be relevant to them. In Part (ii) many candidates could follow the process to find the percentage uncertainty. Some used the intercept value and others divided by the extreme fit value rather than the best fit.

Q3 **(a)** This was poorly answered. Only a few candidates could rearrange the equation to successfully obtain correct values for the constants.

(b) Many candidates scored 1 mark here for ‘none’ as the unit of b. Both units correct was rare in candidates’ answers.

Q4 **(a)** This was generally well answered by most candidates. In Part (i) almost all candidates were given credit. A few introduced an additional decimal place. Some candidates included the anomalous result in Part (ii) but the majority answered this correctly. Almost all candidates wrote down how the value should have been recorded but a significant number just stated that it was in line with the others rather than focusing on the measuring instrument used.

(b) This was quite poorly answered by many candidates. In Part (i) answers were often vague. Part (ii) was answered more successfully by some with many recognising the idea of reliability but missing that averaging improved accuracy.

Q5 **(a)** This was quite well answered by most candidates. Almost all candidates were awarded full credit in Part (i). A common error in Part (ii) was simply to add the percentage errors to reach an answer of 15%. A significant number of candidates were able to answer this part correctly.

(b) This was well answered by many candidates. Some candidates did not double the percentage uncertainty in V.

Q6 **(a)** This was well answered by some candidates but many candidates introduced extra data and were not given credit.

(b) This was poorly answered by candidates. A significant number recognised that the air track would reduce friction but very few were credited with the other marks. The majority of candidates did not recognise that the resultant force was the weight of the suspended masses.

(c) This part was also poorly answered by many candidates. A number of candidates seemed familiar with the set up and answered the question very well but this was rare. Many candidates gave irrelevant answers that did not answer the question that was asked, or gave other considerations which, while they may have been problematic, were missing the major problem of the mass change.

(d) This was well answered by many candidates though some candidates gave vague answers that only gained part credit.

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