Rewarding Learning

CCEA GCE - Physics (Legacy)
Summer Series 2017

Chief Examiner's Report

Foreword

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Education (GCE) in Physics (Legacy) 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 in previous series, poor handwriting in written responses is a difficulty, more so with online marking than paper marking. Candidates should be aware that they should score out and write clear fresh answers rather than overwriting numbers as it is impossible to decipher overwritten numbers especially 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 scripts where the working is unclear. Points on graphs should be clearly marked so that they can be identified clearly during 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 some 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 appropriate 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.

Assessment Unit AS 1 Forces, Energy and Electricity

This paper was generally well received by candidates. Entry numbers were small due to the start of the revised specification.

Q1 **(a)** This question was quite well answered although many candidates could not determine the base units of resistance.

(b) Generally well answered with most candidates gaining full credit. The similarity in Part (i) was sometimes not given credit, Part (ii) was very accessible.

(c) All parts were well answered. In Part (iii) the unit was sometimes quoted as a base unit.

Q2 **(a)** This question proved difficult for many candidates and their choice of axis was often based on the experiment they may have learnt rather than using the information given in the question. This led to incorrect answers in Part (i). A correct choice of axis here usually led to a score of 5 out of 5.

(b) This part also proved difficult. Some candidates did realise u had to stay constant but very few candidates discussed keeping the distance to the first light gate constant.

Q3 **(a)** Most candidates correctly used the relevant equations of motion and gained full credit in Part (i). In Part (ii) a common error was to calculate half the time. Credit was given to those who went on to multiply an incorrect 'half' time by 2.

(b) This was answered well by some candidates, others said a 45° angle should be used.

Q4 **(a)** This was quite well answered. The standard error of 547 N was quite common scoring 2 out of the 3 marks available.

(b) This question discriminated well. Some candidates failed to read the question properly and discussed velocity and acceleration rather than force. 'Gravity' was often given as the downward force and was not given credit. Almost all candidates scored a mark for stating that there was no resultant force when the velocity was constant but the comparison of forces was often omitted for the first and last parts of the fall. 2 marks were generally awarded for QWC.

Q5 **(a)** The definitions were well known although in Part (i) some left out 'direction' and others included the word 'perpendicular'. Part (ii) was usually correct.

(b) Most candidates were able to gain some credit here with many getting full marks. Their working out was, at times, difficult to follow. The addition of standard errors to the mark scheme made this problem a bit easier for examiners.

Q6 **(a)** This definition is very well known. Only a few candidates used the term 'elastic limit' instead of 'limit of proportionality'.

(b) Usually the points were in acceptable positions and both marks were awarded.

(c) In Part (i) it was common for candidates to omit 'when the force is removed' from their answers although some did gain credit. In Part (ii) the mark was usually awarded although some candidates did not start the plastic region at E, possibly just due to inaccurate drawing rather than not knowing where it should start.

(d) These calculations were well attempted by most candidates.

Q7 **(a)** This calculation was quite well done. Most candidates were able to calculate the charge and then some went on to successfully get the second mark.

(b) Most candidates scored full marks in the calculation in Part (i). In Part (ii) few got both marks. Some candidates got the idea that the resistance decreased but very few related this to the temperature decrease.

Q8 **(a)** Ohm's law is well known and most candidates were awarded 2 marks here. In a few cases resistance was incorrectly included in the law.

(b) Almost all candidates got Part (i) correct. Part (ii) was awarded less often. The curvature of graphs was often in the wrong direction.

(c) This part was answered quite well. Candidates working out in Part (i) was generally poorly laid out and difficult to decipher when intermediate marks needed to be awarded. Part (ii) proved difficult for many candidates, few got this correct.

Q9 **(a)** This was quite well answered although some candidates strayed from relevant points and answered Part (ii) in (i).

(b) Both parts were poorly answered, in Part (i) answers lacked precision and in Part (ii) candidates lack of understanding of resistivity was evident.

Q10 **(a)** Most candidates answered this very well. Full credit was gained in Part (i) by almost all candidates and in Part (ii) there were many good answers with correct use of the potential divider equation.

(b) Candidates found this part difficult. Many did not give 0V as their answer to Part (i). Of those who did, they usually went on to gain credit in Part (ii).

Assessment Unit AS 2 Waves, Photons & Medical Physics

This paper was generally well received by candidates. Entry numbers were small due to the start of the revised specification.

Q1 **(a)** This question was very well answered with most candidates calculating the correct range in Part (i). Fewer chose the correct region of the EM spectrum to which the waves belonged.

(b) This was quite well answered although 10^n errors were common. The conclusion was generally correct from their calculated value in Part (i). In Part (ii) a substantial number of candidates used 8 as the maximum value and did not score the second mark.

Q2 **(a)** Most candidates scored part marks here. Many failed to state that 4 or more values were required. A significant number confused the angle A with the angle of incidence and were penalised 1 mark.

(b) Almost all candidates were able to use the equation correctly and scored full marks or 2 out of 3 for incorrectly using A as the angle of incidence.

Q3 **(a)** Almost all candidates recognised the lens as convex or converging.

(b) Many candidates determined a correct value in Part (i) for magnification but did not use multiple measurements of different dimensions for full marks. The calculation in Part (ii) was poorly done by many and discriminated between candidates.

(c) The ray diagram was well attempted although a significant number of candidates failed to place the object correctly. In addition, there were many basic errors of virtual lines, arrows and the position of the eye.

Q4 **(a)** The name of the experiment was well known so most candidates were awarded the mark for Part (i). In Part (ii) many candidates recognised that the single slit wasn't necessary but could not explain why. A significant number did not read the question properly and stated that a laser was not required since the single slit would create a coherent source despite the question being to find the wavelength of laser light.

(b) In Part (i) very few candidates were clear about measuring across a number of fringes. Some described measuring a single fringe and some repeated measurements of a single fringe. The calculation in Part (ii) was very well done. Answers in Part (iii) were often vague and there was some confusion between a decrease or increase by 50% and halving or doubling.

Q5 **(a)** The definition of diffraction was quite well known although some candidates introduced the word 'bending'.

(b) Candidates generally identified sound spreading around a door as an example in Part (i). Candidates found it challenging in Part (ii) to suggest an example for diffraction of a transverse wave.

(c) This part was not well answered by many candidates. A substantial number failed to give the correct width of gap. Wavefronts were poorly drawn and with variable success at a suitable wavelength.

Q6 **(a)** Many candidates were able to calculate the 2 factor but few went on to give the correct unit.

(b) In Part (i) almost all candidates identified the point on the graph but some did not make any reference to the graph in their explanation so were not awarded both marks. Part (ii) was poorly answered with many candidates failing to gain any credit and others gaining some for using an incorrect I_0 value.

Q7 **(a)** Part (i) was well answered by a few good candidates but poorly by the majority, Candidates did not seem to have prepared for this question although it was very similar to a recent past paper question. A difference between conventional x-ray and CT was known by the majority of candidates in Part (ii).

(b) This was quite well answered although some answers lacked detail and in Part (ii) many candidates recognised that there would be damage to the foetus but failed to mention ionising radiation.

Q8 **(a)** Some candidates demonstrated superficial knowledge of the photoelectric effect and failed to gain maximum marks due to lack of rigour or detail in their responses. Most candidates were fully awarded for their quality of written communication.

(b) This was well answered by some candidates and while most realised that they should find the gradient of the graph, many did not use the intercept value and treated the line as though it started at the origin.

Q9 **(a)** Poorly answered. Many candidates focussed on explaining the uniqueness of human fingerprints and failed the include sufficient detail in their responses to be awarded marks.

(b) A surprisingly large number of candidates could not work out the number of lines from the energy level diagram in Part (i). The steps in changing an energy to a wavelength are well known by candidates and in Part (ii) the only difficulty that many had was in selection of the energy difference.

Q10 **(a)** Many candidates failed to obtain both marks available. Reflection was not always chosen as a wave and particle example.

(b) Only some candidates correctly suggested the atomic spacing or equivalent as similar to the wavelength in Part (i). Most candidates made good attempts in Part (ii) at deriving Einstein's equation although the responses were often confused and working was difficult to follow.

Assessment Unit AS 3 Practical Techniques

The standard in this paper was quite high, most candidates scored well throughout the short practical tests and in the final question.

Q1 **(a)** Most candidates scored full marks in this part. Some values of T seemed small suggesting that the number of oscillations had not been counted correctly. A few recorded T to 3 dp and sometimes headings were not detailed enough or units not given in the correct format.

(b) The calculation of the constant b was generally well done. Only a few candidates did not give the correct unit.

Q2 **(a)** A significant number of candidates failed to include an arrow on one or more rays. Some candidates confused the angle of refraction with the angle of the emergence.

(b) Calculating the refractive index in Part (i) caused few difficulties. In Part (ii) a significant number of candidates measured the width of the block instead of the length of the refracted ray. Many candidates incurred 10^n errors in the calculation of the time taken for the light to travel through the block. Candidates were penalised if their value of speed of light in the block was greater than 3×10^8 m s^{-1}.

Q3 **(a)** Readings of V were often just given as a whole number rather than the 2 decimal places as expected and readings of I were not always to a consistent number of dp's. A value of (0,0) is not deemed appropriate to be used as one of the 5 acceptable sets of values but was not penalised on this occasion.

(b) The equation was known and used correctly by almost all candidates but there were some 10^n errors.

(c) Some candidates correctly identified the component but very few could fully justify their choice.

Q4 **(a)** Most candidates had made correct measurements but they were not always recorded to the correct degree of accuracy consistent with the instruments used. Some centres had supplied candidates with balances other than those specified in the instructions. On this occasion candidates were not penalised in these cases.

(b) Most candidates calculated density correctly but a significant number failed to record it to 2 significant figures as required by the question.

(c) This was well done by most candidates. Some failed to double the percentage uncertainty in d.

Q5 **(a)** Most candidates could correctly rearrange and map the equation obtained to that of a linear graph in Part (i) to get full credit. Values in Parts (ii) and (iii) were usually calculated correctly but some gave their answers of h_i/h_o to 3 significant figures. Some candidates incorrectly gave a unit of cm for this ratio. The graph in Part (iv) was very well plotted with only a small number of candidates ignoring the axes provided. Best fit lines were accurately drawn.

(b) Many candidates could correctly calculate the gradient of the graph in Part (i) and give the appropriate unit. In Part (ii) the determination of the focal length was well done but a significant number of students did not include a unit with their value.

(b) Part (iii) was well answered. A small number of candidates omitted the negative sign and a few candidates obtained an answer by calculation.

(c) This was answered well by some candidates but many had difficulty. In Part (i) some candidates incorrectly attempted to determine the percentage uncertainty in the value of the gradient rather than the intercept. Some of the extreme fit lines drawn to obtain the answer in this part were not appropriate. Using -1 from the equation was an alternative to find a second value for the intercept from which to determine the percentage uncertainty.

Very few candidates obtained the mark in Part (ii). Many stated the image was 'upright' or omitted 'real' if they knew it was inverted. In Part (iii) very few candidates scored 2 in this question. Manipulation of the equation proved difficult for some and often there was no reference to the equation at all.

Assessment Unit A2 1 Momentum, Thermal Physics, Circular Motion, Oscillations and Atomic and Nuclear Physics

In general, this paper proved challenging for many candidates and it is recognised that lack of time was an issue. A number of candidates omitted some parts of the paper although it was unclear in all cases whether this was due to lack of time or inability to answer the parts they had omitted.

Q1 **(a)** The statement of the pressure law was well known by most candidates although some omitted key term such as 'absolute' temperature or 'fixed mass'.

(b) This was very well answered. A few candidates did not read the question correctly and answered in terms of the energy of the molecules rather than their motion.

(c) Most candidates managed to gain some credit here for the attempted use of the equation. Candidates continue to have difficulty when absolute values are not given for quantities and they have to deal with percentage change. Many stopped before the final stage of the working scoring 3 out of 4. Most candidates did convert temperature to Kelvin but some incorrectly worked with °C.

Q2 **(a)** Well answered. A few candidates gave a general definition of specific heat capacity rather than answering the question that they had been asked.

(b) In Part (i) candidates had a good general knowledge of this experiment although in some cases their responses lacked detail and order; this was penalised in QWC. Part (ii) was well answered.

(c) Candidates found this calculation in Part (i) challenging. Many failed to realise that there was as common temperature reached and, of those who did, most were not able to deal correctly with the mathematics so only scored part marks. There was a mark given to any candidate who showed recognition that the heat lost by the coffee was gained by the mug. In Part (ii) candidates often got the idea of the specific heat capacity of coffee being higher. The mass difference was rarely mentioned to score the second mark.

Q3 **(a)** Some candidates answered this well although many did not make a clear link between acceleration, change in velocity and direction change.

(b) This part was answered very well by some candidates. Those who got Part (i) correct tended to complete Parts (ii) and (iii) successfully. Some did not include the mass of the pilot in their substitution and could only score 1/2. Some did not convert mass to weight and some used sin 60 instead of cos 60.

Q4 **(a)** The definition of simple harmonic motion was well known by many candidates. Several candidates failed to include 'fixed point' in their answer. Some used the word 'distance' in place of 'displacement'.

(b) Candidates found this calculation challenging although a good proportion reached the correct answer. Many candidates could access at least 3 of the 7 marks available and ecf for incorrect values of A and x led to many gaining a further 2 or 3 marks. Some candidates did not use radian mode on their calculators.

Q5 **(a)** This was well done by many candidates but some did not recognise it as an application of momentum conservation. Most correctly calculated the velocity of the alpha particle and used this to determine the recoil velocity. Many candidates used 210u as the mass of the resulting radioactive nucleus instead of 206u and scored 3/4.

(b) Both parts were well completed by the majority. A significant number of candidates were unable to correctly label the diagram in Part (i), the microscope and zinc sulfide screen were often incorrect. Almost all candidates scored both marks in Part (ii). On occasions the positive charge was omitted.

Q6 **(a)** Few candidates gained credit in Part (i). Answers lacked all the detail required to explain both 'radioactive' and 'decay of the nucleus'. Most candidates got some credit in Part (ii) but a significant number of candidates lost marks. Some stated that the S.I. unit of activity was s^{-1}. N was also incorrectly identified by a number of candidates.

(b) Several candidates got this part correct although in some cases their working was difficult to follow. Most were given credit for calculation of the decay constant and many, being unable to calculate consistent values of A and AO, still gained 3 marks out of a possible 4.

Q7 **(a)** Both Parts (i) and (ii) were well answered by most candidates. Some did not specify nucleons or protons and neutrons and were not credited. The calculation in Part (iii) was very well answered. Solutions were well set out logically structured. This calculation and resulting value is very well known by candidates.

(b) Many candidates scored 2/3 in Part (i) with correct explanation of nuclear fusion and stating that high temperatures were required. The 3rd mark was obtained by only a very few candidates. The calculation in Part (ii) was poorly attempted by many candidates. In many cases, it appeared that candidates did not know how to approach the question. For those that did, 10^n errors were common. The proof in Part (iii) was well done by the majority. Only a few candidates did not seem to be able to start their solution. Some candidates went straight to the answer of 1.2×10^4 ms^{-1} from the substitution and so could not obtain the second mark.

Q8 **(a)** Few candidates scored full marks in this question. Many did not apply F=ma to each mass as required in the stem of the question. A significant number seemed to guess that the value of Q was 9.81ms^{-2} or 'g' and scored 1/4.

(b) A large number of candidates found it difficult to rearrange and map equation 8.2 in Part (i). The table in Part (ii) was completed accurately by most candidates but errors due to incorrect number of significant figures were common. The graph in Part (iii) was well plotted by many candidates. Some scaling errors were evident. Best fit lines were good. The gradient was calculated correctly in Part (iv) by the majority of candidates who answered this question. Most were then able to multiply their answer by 500 and obtain 2/3. A significant number stated the unit as ms^{-2}g. In Part (v) most candidates knew that the graph would be steeper but could not fully explain why. Many candidates gave their answer in terms of the speed in Part (vi) and not the time.

Assessment Unit A2 2 Fields and their Applications

The standard of answers in this paper was generally good. Candidates seemed to manage to answer parts of all questions successfully and there were no timing issues.

Q1 **(a)** The names of the laws were known by most candidates although a few omitted the '3rd' for Kepler's law. Part (ii) was well answered by almost all candidates, they are well-practised at this derivation.

(b) The calculation in Part (i) was very well done. A few candidates did not convert the time to seconds. Part (ii) was less well answered with many candidates using values from Part (i) to try to calculate an answer. Some used the 3 factor but failed to square the 2.

Q2 **(a)** Candidates who used Coulomb's law equation tended to be most successful here. Those who took the units F m^{-1} from the data sheet quite often could not find base units for the Farad. Some mistook it as the quantity force and used the base unit of the Newton.

(b) The majority of candidates gave general differences here without any thought to the question that they had been asked which was specific to the fields around a proton.

(c) Coulomb's law was well known by most candidates although some careless errors were introduced when parts of Newton's law of gravitation were mixed into their answers. The calculation in Part (ii) was very well done. A few 10^{n} errors occurred but were rare.

Q3 **(a)** The quality of the circuits varied widely. Many candidates scored full marks but some failed to include any resistance, others had circuits that couldn't be charged and some just connected all the components mentioned in series.

(b) In Part (i) candidates often failed to score both marks. The voltage being stepped up was more often given credit than the change from ac to dc. In the calculation in Part (ii) most candidates gained full credit although some did not use the correct equation, commonly omitting the ½ and didn't get credit. Part (iii) was well answered by most. The discharge equation was more often used than working out the number of time constants.

Q4 **(a)** In Part (i) many candidates failed to explain where the force originated. Some candidates approached the force on the magnet as coming from an interaction of the two magnetic fields while others discussed Newton's 3rd law. Both were given credit. Many were vague in their explanation of what caused the downward force and did not mention the magnet. Part (ii) was answered well by most candidates.

(b) Few candidates scored full marks here. 10^n errors in converting mg to kg were common and many candidates failed to convert to Newtons. Some incorrectly read points from the graph and lost a mark.

(c) In Part (i) some candidates did not read the question correctly and lost the mark. The mark in Part (ii) was often awarded for the idea that the wire would heat up although most candidates did not see it as a safety issue.

Q5 **(a)** Faraday's law was given in a variety of forms with most candidates gaining credit here.

(b) Many candidates got to the correct answer using reasoned working. A substantial number just used one point from the line rather than a change in B.

(c) Part (i) was poorly answered showing that many candidates lack real understanding of the concept. More got Part (ii) correct, most electing to reverse the polarity of the supply rather than increasing the current.

(d) Part (i) was very well answered with most candidates scoring full marks. In Part (ii) many candidates divided the two current values and were not given any credit. Those who calculated power from the current values, where one of the P values was incorrect will have reached the same incorrect answer but have been credited with 3 marks. The correct answer was rarely seen.

Q6 **(a)** Almost all candidates scored both marks in this part.

(b) Some candidates answered this question well but many did not give enough detail in Part (i), stating that a 'wave' would be seen when the timebase was turned on. Few candidates knew what would be seen with the timebase off. Part (ii) was well answered.

Q7 Many candidates showed good knowledge of both types of accelerator and tended to write everything that they knew down without putting it into the context of the question. A separate paragraph for each accelerator was common which was not ideal when the question had asked candidates to 'compare and contrast'. This was taken into consideration in the quality of written communication marks. Commonly candidates scored 2 marks for the contrasts but often only had 1 comparison of the structure and method of acceleration in their answers.

Q8 **(a)** Most candidates scored 2 of the 3 marks available here with Part (i) being the least well answered. Many candidates gave vague descriptions of what an antiparticle might be. Part (ii) and (iii) were very well known. Spelling of annihilation was often poor.

(b) Few candidates scored full marks in Part (i). Many did not seem to read the stem of the question and so didn't understand the process. This resulted in attempted use of $\frac{1}{2}mv^2$ to try to calculate a kinetic energy. Some gained partial credit for calculating the energy of the photon. In Part (ii) those candidates who knew the structure of a meson had no problem gaining full marks but many candidates used combinations of three quarks or did not have quark/antiquark combinations.

Q9 **(a)** Part (i) was answered well by most candidates although some didn't calculate the circumference correctly. Part (ii) was answered well by some candidates but many used the 18 and multiplied it by 2π.

(b) Almost all candidates got the magnification correct in Part (i). Part (ii) was rarely answered correctly. Most candidates failed to recognise that $u + v = 12$ cm. A seemingly correct numerical answer appeared often but the physics leading to it was incorrect so it was not given credit. In Part (iii) it was common for candidates only to give one or two of the three required words. Of those who did give three they were rarely all correct, upright being the most common error.

(c) Many candidates seemed to have a general idea of what a plasma is for Part (i) but found it difficult to define. In Part (ii) some candidates showed understanding to gain credit but others discussed laser action. Part (iii) was not well answered by most candidates, many described dispersion of white light through a prism.

(d) Most candidates had the idea of a single plane but many did not specify that it was oscillations or vibrations in a single plane in Part (i). Part (ii) was quite well answered by some candidates but many answered lacked the detail of what should be done with the polaroid filter and some candidates described the use of 2 polaroid filters.

Assessment Unit A2 3 Practical Techniques

Most candidates scored highly in this paper with many in the range of 80-90%. Question 3 was more discriminating than Questions 1 and 2.

Q1 **(a)** The vast majority of candidates drew accurate emergent rays refracting in the correct direction.

(b) Candidates completed their diagrams well with extensions to the incident and emergent rays evident.

(c) Most candidates scored full marks here. Some candidates failed to give angles in whole numbers. Some candidates lost marks with incorrect or inaccurate values of the angles of incidence. A few candidates failed to obtain D results that decreased and then increased.

(d) In the drawing of the graph in Part (i) many candidates lost marks for inappropriate scales. Some transposed the axes. A few failed to draw appropriate curves although this was challenging on occasion. The minimum angle of deviation in Part (ii) was in general well-chosen and most candidates were credited for Part (iii) where the subsequent angle of incidence was also well determined.

(e) The apex angle of the prism was usually correctly measured in Part (i). The calculation in Part (ii) was generally well completed. Part (iii) offered a degree of discrimination as some candidates failed to use appropriate angle values in the determination of the maximum value of the refractive index (minimum value in session 2). Most gained the final mark for the difference in the values.

Q2 **(a)** Full credit was given to most candidates here. Some candidates failed to use appropriate frequency values. Most candidates obtained acceptable values for current and voltage that were given full credit.

(b) Most candidates gained the marks for this calculation. Some incorrectly gave values to 4 significant figures and a very small number made power errors.

(c) Candidates generally correctly calculated log values in Parts (i) and (ii). However, some candidates used natural logs and some failed to quote answers to 2 decimal places as per the question. A significant number of candidates failed to head the column appropriately. A significant number of candidates transposed the axes in Part (iii). Some scales were inappropriate. Best fit lines were generally well drawn.

(d) Gradients were generally well determined in Part (i) although many candidates failed to follow the direction of 2 significant figures. Many candidates found the intercept incorrectly from their graph in Part (ii). Some candidates could use their graph if their scales had been inappropriate. Some found the intercept but converted it from the log value. In Part (iii) a significant number of candidates showed clearly their correct determination of C. Some failed to convert from the log value or failed to correctly equate anti-log value with the equation.

Q3 **(a)** This was poorly answered by many candidates, with some being awarded only 1 mark for the equation of gravitational potential energy.

(b) Some candidates identified the correct axes in Part (i) but drew a straight line through the origin. Most candidates offered well drawn tables in Part (ii). However, some tables were poorly drawn. Most candidates included x and x^2 with appropriate units, but many failed to include repeats of d and hence average d. A significant number of candidates failed to indicate that they would take at least 5 values for x. Some candidates only offered 2 variables to control in Part (iii). Others offered the extension of the spring or the distance travelled by the ball bearing. The gradient was generally identified and credit given to most candidates in Part (iv).

(c) The majority of candidates offered the correct instruments to measure distance, extension, mass and angle in Part (i) and scored 1 mark. Many candidates failed to give any further detail on their measurement. A significant number of candidates recognised the requirement for an extreme fit in Part (ii). However only the higher scoring candidates suitably explained how to use the gradients to obtain the percentage uncertainty.

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