GCSE

Rewarding Learning

Chief Examiner's Report

Physics

Summer Series 2018

Foreword

This booklet outlines the performance of candidates in all aspects of CCEA's General Certificate of Secondary Education (GCSE) 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.

Contents

GCSE PHYSICS

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General Comments

At Foundation level the candidates responded less favourably than in previous years.

However, for this new specification, it would be suspected that this might be attributable to the entrants being entirely from a Year 11 cohort and thus less academically and/or mathematically mature.

The quality of responses at the Higher Tier was pleasing with an average mark for the paper similar to previous years. Some areas of weakness include the use of velocity-time graphs and the calculations involving velocity, time and acceleration.

The more able candidates were able to gain access to high marks. Calculations were usually well presented. Candidates should be encouraged to state the equation they plan to use for their calculations either in words or accepted symbols. If they change their plan they need to clearly show this by deleting any earlier equation they have written down.

Assessment Unit 1 — Motion, Force, Density and Kinetic Theory, Energy, and Atomic and Nuclear Physics

Foundation Tier

The entry was 32 and the mean score for the paper was 41.7 out of 80 marks.

Q1 **(a)** Candidate responses were generally pleasing and proved to be an acceptable introductory question.

(b) In general candidates either scored well or poorly on this. Many failed to appreciate that a decrease in the measured times between successive 1m markers indicated an increase in speed and hence acceleration. The need to average repeated results was often omitted in Part (ii).

(c) **(i)** On the whole this was quite well attempted by most, but some failed to use 4 seconds as instructed to do so and chose to use 5 seconds. In Part (ii) too many candidates appeared not to know that the distance travelled was equal to the area under the speed – time graph and simply resorted to the use of $d = v \times t$. Some candidates failed to recognise that the car started to slow after 1s and, as in Part (i), and used a time of 5 seconds.

Q2 **(a)** All parts, by and large, attracted correct responses but rather surprisingly a few candidates did not know friction was a force.

(b) Responses here were good although in Part (ii) some candidates calculated the extension but omitted to add the un-stretched length of the spring.

(c) **(i)** A good number of candidates did not identify the centre of gravity as a point at which the weight acts and consequently did not achieve full credit. Part (ii) proved to be a real challenge with many candidates not providing an explanation in terms of moments but choosing to attempt it via the concept of stability.

(d) **(i)** Candidates provided an array of responses here with some calculating only the moment due to the 25 N weight or used 30 cm as the distance. However, some candidates achieved full credit, or close to it, by setting out their attempt in a clear manner.

Overall the responses for Part (ii) were good but some candidates failed to recognise the area was given as 5 cm^2 and proceeded to calculate it as 5 × 5 cm^2.

Q3 **(a)** In Parts (i) and (ii) candidate responses were in general good, but with some failing to gain credit because of unit omission or offering an incorrect unit. A small number of candidates were unable to obtain the correct mass and volume values from the given data and others used an incorrect equation such as D = M × V.

Part (iii) attracted a variety of acceptable responses.

(b) Many candidates achieved only partial credit by failing to mention the vibration about a fixed point in the case of glass/solids. Several candidates proceeded to continue with the concept of density and explained the difference in density in terms of "atom packing" between solids and liquids and this resulted in no credit.

Q4 **(a)** Stopwatches and metre rules/measuring tapes, in addition to many other unnecessary items, were identified as the apparatus required. For measurements some chose, distance without specifying it as height of stairs, length and height of steps and weight of person despite this having been emboldened in the stem of the question. For calculations it was pleasing to note that many knew the equations for work and power to achieve some credit. There were some candidates who achieved full credit and in some instances with the minimum of written content; the procedure was obviously well known by them.

(b) Responses in this section were, in the main, good although the equations for calculating kinetic and potential energy were not always presented.

(c) On the whole responses here were pleasing with most candidates being awarded at least partial credit.

(d) **(i)** Many candidates were to draw appropriate graphs.

In Part (ii) the electron was usually identified but for Part (iii) descriptions were poor with many thinking the electron moved and carried the energy along the wire as opposed to it colliding with the atoms/ions.

In Part (iv) full credit was not always awarded because of the failure to identify the concept of heat energy being passed on from one atom/ molecule to the next via vibration.

Q5 **(a)** On the whole responses demonstrated a good understanding of background count and half-life.

(b) The majority of candidates identified the process as fission although the spelling was not always correct. In a good number of instances, the candidate provided a rather vague description of the process, some of which were not credit worthy. Generation of electricity as a peaceful use for fission was often offered.

(c) The majority of candidates identified the process as fusion although the spelling was not always correct. Identification of hydrogen and helium was not always in evidence, but it was known by most candidates that fusion happened naturally in stars/sun.

Higher Tier

The entry was 1201 and the mean score was 72.6 out of 100 marks.

Q1 **(a)** This was very well answered. Most candidates gained high marks demonstrating a good level of knowledge and understanding of motion and the interpretation of distance – time graphs.

(b) This was not well done. Many candidates displayed a limited knowledge of the requirements, namely measure two timings and looking for a decrease. Light gates were often suggested as a way of improving reliability as opposed to simply repeat measurements and calculating an average.

(c) Part (i) was nearly always correctly answered. Responses to Part (ii) fell into two categories, if the candidate knew that the area under the velocity – time graph gave the displacement (distance) gained, for the most part, full marks. Those who did not know that the area under the graph, of which there were many, did not gain any credit. For some who knew that the area under the graph was the way to proceed failed to calculate the area correctly.

Part (iii) could be answered by the simple statement that the graph did show a straight line of constant slope, however many candidates took many lines of writing to arrive at a creditworthy response.

(d) Those candidates of good ability scored well in all three parts of this section of Question 1. Common mistakes included finding the average velocity by dividing the distance by the final velocity, using the final velocity rather than the average velocity to calculate the time to travel the distance. Many candidates were able to gain some credit from errors carried forward from one part to the next.

Q2 **(a)** **(i)** Most candidates were able to apply Newton's 2nd law of motion by finding the resultant force and calculating the acceleration. In Part (ii) many realised that a decrease in the mass, or a downhill section of the motorway would result in a greater acceleration.

(b) **(i)** **&** **(ii)** This was very well answered; the axes of the graph were labelled with the correct unit and plots accurately plotted. Examiners were generous when giving credit for a smooth curve.

(c) **(i)** **to** **(iii)** Hooke's Law made an appearance after some absence and it was disappointing to note the number of candidates who did not score well in relatively straightforward questions on this topic. Few knew the unit for the spring constant.

(d) **(i)** The most common error was not looking carefully at the diagram to identify the correct distance from the clearly marked pivot to the attached weight.

The calculation of pressure in Part (ii) was generally well done. However, a number gave the equation for pressure but could not re-arrange it to make force the subject of the equation.

Q3 **(a)** **(i)** **to** **(iii)** This was very well answered. Nearly all candidates were able to calculate the density and give the correct unit. A small number were able to identify the volume and mass in Part (i) but failed to use the values to calculate the density of the liquid. A similar small number of candidates were not able to give the units for density. In Part (iii) most knew that reading to the bottom of the meniscus level was required for an accurate reading of the volume of the liquid in the measuring cylinder.

Part (b) was poorly answered. Candidates were asked to differentiate between the motion of the molecules in water and in glass. Instead it was often the case that candidates described the arrangement of the molecules in solids and liquid rather than the motion as demanded by the question.

Those who had a good understanding of the relationship between mass, volume and density scored well in Part (c).

Q4 **(a)** The quality of responses ranged from brief and precise to rambling and confused. Measuring the vertical height of the stairs or the step-up platform was often not clearly stated. Many wanted to weigh the person although they were told that the weight was known. Measuring the person's mass and then converting to a weight, although correct often lead to further confusion when the equation for determining work and power were stated. I should point out that giving an equation in terms of acceptable symbols such W = f × d for work is acceptable in a QWC question, the equation does not have to be written in words.

(b) Most were able to correctly identify from the list energy resources as either renewable or non-renewable. Some did not know that Biomass was a renewable energy resource. A smaller number felt that nuclear power was renewable.

(c) (d) The energy transfers in a mobile phone were correctly identified by most of the candidates and the efficiency calculation was equally well done.

(e) **(i) to (iii)** The calculation of potential energy presented few difficulties for the candidates and did the task of showing the relevant steps needed to show the value of the velocity given the kinetic energy. Part (iii) proved much more a challenge with only the best candidates equating work done with kinetic energy.

(f) **(i) & (ii)** Most correctly sketched the graph to show how the temperature of copper and glass changed with time. Descriptions of the role particles play in the conduction of heat by a metal were often poor, collisions between the electrons and the metal atoms were rarely mentioned.

Q5 **(a)** Most were able to use the decay graph to determine the half-life of the radioactive source.

(b) This was a QWC question. Many produced coherent responses scoring highly. A gamma ray source was identified by most candidates but some struggled when dealing with issue of the half-life of the radioactive source. Some felt that a long half-life would lead to radioactive aluminium. Precise descriptions on how the gamma rays are used to control the thickness of the metal were provided by only the best candidates.

(c) Most were able to identify the particles involved in nuclear fission. Acceptable descriptions of the role the particles play in a chain reaction were difficult to find.

(d) Many were able to name tritium and deuterium as the isotopes of hydrogen involved in the fusion reaction, even if their spelling of the isotopes were not precise.

Contact details

The following information provides contact details for key staff members:

- **Specification Support Officer: Nuala Tierney**
  (telephone: (028) 9026 1200, extension: 2292, email: ntierney@ccea.org.uk)
- **Officer with Subject Responsibility: Gavin Gray**
  (telephone: (028) 9026 1200, extension: 2270, email: ggray@ccea.org.uk)

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COUNCIL FOR THE **CURRICULUM, EXAMINATIONS** AND **ASSESSMENT**
29 Clarendon Road, Clarendon Dock, Belfast BT1 3BG
Tel: +44 (0)28 9026 1200 Fax: +44 (0)28 9026 1234
Email: info@ccea.org.uk Web: www.ccea.org.uk

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