Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel Advanced GCE
In Physics (9PH0)
Paper 1: Advanced Physics I

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Introduction

This paper consisted of 90 marks split between multiple-choice, short open, open-response, calculations and an extended writing question. The questions examined a range of topics from approximately half of the specification, and included synoptic questions drawing on two or more different topics.

Questions requiring straightforward calculations were completed confidently by almost all candidates. Many candidates produced a good attempt at the questions involving multiple calculations. Occasionally, in calculation questions, the final mark was not awarded due to a missing or incorrect unit. The calculation was occasionally not clearly laid out, with no formula stated and/or no substitution evident.

There were many examples of candidates disadvantaging themselves by not answering the question, or by not expressing themselves using suitable language. Scientific terminology was used incorrectly in certain responses seen on this paper – most notably when answering question Q11(b)(ii).

The space allowed for responses was usually sufficient. Candidates should be encouraged to consider the number of marks available for a question, and use this to inform their response.

This paper was taken by a relatively small number of candidates. The following comments on individual questions are based on candidate work.

Question 11

This question combined the concepts of circular motion and weight. It started with part of a standard derivation for the acceleration to the centre of the circle.

(a)

A correctly completed and labelled vector triangle was occasionally seen. A number of answers showed the addition of the two velocity vectors rather than the difference. The two lines labelled velocity were sometimes not connected. The third side of the triangle, the change in velocity and acceleration, was then impossible to complete.

(b)(i)

The calculation was completed successfully in most cases. The units $m\ s^{-2}$ were sometimes missing or incorrect. A number of answers omitted to square either the radial speed *w* or the speed *v*.

(b)(ii)

Many answers correctly identified that the astronauts would not be "weightless" but would have a weight due to the reduced gravitational field strength at the orbit of the ISS. A number of responses confused centrifugal, centripetal and resultant forces with only a small number of candidates stating that the only force acting on the astronaut in this case is the weight.

Very few answers discussed our perception of weight. This is due to reaction or contact forces from the floor or ground. This is zero when orbiting in the ISS hence our notion of "weightlessness".

Question 12

This question started with an appreciation that the area under a Force-time graph represents change in momentum. The second part was a projectile calculation.

(a) and (b) (i)

Most candidates correctly explained that impulse is the area under the graph because it represents the product $F \times t$.

Many candidates then simplified the area under the curve as a triangle within the shape on the graph. This triangle has a smaller area than the shape given in the graph and results in an underestimate of the velocity required.

A good method would have been to make the height of the triangle slightly more than 4800 N but still with a base of 0.5 ms.

(b) (ii)

This was an extended calculation and a number of methods could be employed.

A correct method which was commonly seen was to calculate the horizontal component of velocity using the required range of 70 m and the time of flight 3.5 s. The method then went on to use $s = ut + \frac{1}{2}at^2$ to predict the vertical component of velocity required to produce a vertical displacement of 7.5 m after a time of flight of 3.5 s. Use of pythagorus to combine the two components of velocity to predict a minimum resultant velocity required and compare with 30 m s^{-1} for full credit.

Question 13

This question examined electric field lines and a capacitor-resistor discharge.

(a)

Many answers gained the first three marks. It was clear that many candidates had been taught the requirement for electric field lines to be perpendicular to potentials. Few answers showed the field strength decreasing outside the plates for the final mark.

(b)

Many candidates started this calculation well by using a correct method to determine the resistance using the discharge graph. A common error was to leave the time in hours. Most answers then went on to use the resistivity equation correctly. Many candidates responded well to the “deduce whether…” prompt and wrote a sensible conclusion based on a comparison of values.

Question 14

This was a topical question about a solar powered car.

(a)

This calculation, to find the internal resistance of a battery, was handled well by most candidates.

(b)

This calculation, involving an energy measured in kW h, was handled confidently unless the student tried to convert this value into J.

(c) (i) and (ii)

Many candidates did not appreciate the situation being described in this question. There are resistive forces acting on the car. As the car initially accelerates from rest these resistive forces would increase until the car reaches a constant velocity. The corresponding acceleration would decrease to zero. Many calculations were still fully credited. It is only in part (ii) that this lack of a full appreciation of the situation revealed itself. Responses such as “there are no resistance forces” were common.

Question 15

This question asked for the conclusions to the golf leaf scattering experiment and followed with a calculation using the equation for potential in a radial field. There were some very good responses to both these parts. The final question was a novel context, and this proved more demanding.

(a)

This question was well-answered, but some responses included unnecessary detail about the experimental results from the scattering experiment.

(b)

If candidates picked the correct equation for potential at a distance from a point charge then they often went on to gain full, or close to full, credit. The equation for force between two charged particles is not appropriate in this instance.

(c)

This novel context proved demanding. Candidates sometimes appreciated that observation 1 indicated that less force is exerted on the alpha particles by aluminium nuclei, but they rarely connected this with less charge. Many answers referred to relative differences in sizes of nuclei.

Very few responses demonstrated any knowledge about the recoil of nuclei in the scattering experiment. A few responses managed to consider the relative masses of aluminium and gold nuclei in their discussion of observation 2 for partial credit.

Question 16

This question, about the decay of the lambda particle, contained the extended writing answer for the paper. Some excellent responses were seen to the various parts of this question.

(a)

This was an extended writing question which assesses the candidates' ability to show a coherent and logical structured answer with linkage and fully sustained reasoning. There are 6 indicative content (IC) points, for which a maximum of 4 marks can be awarded. There are two further marks available for appropriate linkage of ideas.

The first two IC points were made in almost all cases. There had to be some appreciation that the particle tracks can be used to determine the momentum of the particles to gain further credit. A reasonable proportion of responses developed the discussion to achieve full marks.

(b)

This question was well-answered. Candidates should take care to make sure they convey all the information carefully, e.g., some answers lacked the detail as to whether the pion was or wasn't a baryon.

(d) (i)

This calculation was completed well by many candidates.

(d) (ii)

Most candidates confidently used either GeV or MeV. Some responses did not include the mass of the lambda particle. Some responses muddled the use of MeV and MeV/c^2 by multiplying or dividing by $(3 \times 10^8)^2$.

Question 17

This question invited candidates to apply their understanding of Fleming's left hand rule and the electromagnetic induction laws to a moving coil ammeter.

(a) (i)

Many responses stated “clockwise” or “anticlockwise” but with little or no attempt to explain their thinking. Adding forces to either diagram would have been a good way to convey an explanation.

(a) (ii)

Some responses correctly identified the need for a moment of the force (BIl × distance). Very few candidates used the correct distance from the pivot (force × $w/2$) so often didn't gain any further credit.

(b)

This calculation on series resistors was completed well by most candidates.

(c)

Responses often started well by applying Faraday's law to the situation described in the question. Some developed the argument further by commenting on both the induced emf and corresponding current as the coil provides a closed circuit when the terminals are connected together. Lenz's law was then often quoted but it needed to be applied to this context to gain credit.

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