Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2021

Pearson Edexcel Advanced GCE
In Physics (9PH0)
Paper 3: General and Practical Principles in Physics

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November 2021
Publications Code 9PH0_03_2111_ER

General point:

Candidates had difficulty in knowing when they were supposed to address the precision/accuracy/uncertainty of the values/experiment/equipment and when they should be talking about the method/ technique. Candidates would benefit from more teaching on this area. Also, candidates should be advised that looking at the stem of the questions, command words such as 'comment' and 'criticise' on their own do not entirely indicate what is required and questions will tend to use precision/accuracy/uncertainty if that is what is required in the answer. Teachers are advised to make candidates aware of this, as it would prevent candidates wasting unnecessary time in the examination.

Q1(a)

This was a straightforward question, and most candidates were able to complete the calculation successfully.

Q1(b)

The marks were scored most easily by referring to definitions of precision and accuracy. A number of candidates confused precision with resolution. Resolution is the smallest measuring interval (in this case 0.01 g), whereas the precision refers to the closeness of agreement (consistency) between values obtained by repeated measurement.

Q2

As there was the potential for candidates to make points in (a) that relate to (b) and vice versa, this question was marked holistically.

Many candidates stated that 2 readings were not enough - but fewer candidates realised that the time was too short. The fact that the GM tube would not detect alphas and the lack of a background count were often seen.

Q3(a)

This was generally well answered, although some candidates were not sure how to calculate the volume of a sphere. Some candidates used the area of a circle, others the volume of a cylinder. Candidates should be aware that mathematical formulas are not included on the exam paper, and so they will need to memorise these.

Q3(b)

Responses to this question were quite mixed. Generally, there was some understanding - but only a few candidates produced a fully correct solution.

Some candidates used half resolution and then doubled it. Many candidates added the percentage uncertainties, but fewer candidates remembered to multiply by 3, (even those who had used the correct volume formula).

Most responses included a conclusion, but these were sometimes poorly expressed.

Q4(a)

Some candidates could state what makes a decay spontaneous, but many candidates thought that 'spontaneous' means the same as 'random'.

Q4(b)

This question required logical links to be made between ideas. As some of the ideas are quite difficult to explain, it was rare to see 5 or 6 marks awarded. Some candidates didn't get much further than the idea that the larger the number of nuclei in the sample the higher the rate of decay, and hence over time the rate of decay would reduce.

A number of candidates seemed to think that unstable nuclei trigger other nuclei to decay, hence the smaller the number of nuclei the lower the rate of decay. There was also a lot of confusion with fission.

Q5(a)(i)

As might be expected, the common error was to take the resolution of the instrument rather than half the resolution. There were also some power of ten errors. Some candidates thought that the bottom had a larger error than the top, perhaps because the reading of the position at the bottom of the liquid column was smaller than that at the top.

Q5(a)(ii)

Some candidates worked out the % error in each reading and then added these % errors. Some gave 3sf in their value, which was too many on this occasion.

Q5(a)(iii)

Good responses were seen to this question. A small number of candidates seemed to think that the values of *r* should increase in equal increments, although there is no reason why this should be the case.

Q5(b)(i)

This question was generally answered well. A few students did not draw a line of best fit.

Q5(b)(ii)

Many did not seem to realise they needed to comment on the raw data and their attempts only targeted marking point 3 and marking point 4.

Q6(a)

This was another question that required logical links to be made between ideas.

There was a large difference between candidates that had a reasonable understanding of the situation and those that did not. IC6 was quite often seen, but very few candidates scored IC5. In weak responses IC2 was usually the indicative content point seen.

Too many candidates asserted that apparent weight is greater at the top, which indicates either a lack of experience of this type of amusement park ride or a misunderstanding of what is meant by “apparent weight”.

Q6(b)

The responses to this question were quite disappointing. Many candidates seemed to accept the use of the phrase “centrifugal force”, and often went on to include it in their argument. However, a few candidates scored MP5 for recognising that “centrifugal force” should have been “centripetal force”.

Few attempted the argument in marking point 2 and marking point 3. Some candidates scored marking point 4 and made some sensible comments. There were a few that scored marking point 1 although usually indirectly.

Q7(a)(i)

This was a straightforward question for most candidates, although some candidates went on to calculate an rms value.

Q7(a)(ii)

There was confusion about which resistance to use here, and so many responses missed out on marking point 3 as their final answer was incorrect.

Q7(a)(iii)

Candidates had often calculated the total circuit resistance in (i), so this was credited here. Those candidates who chose to use $P = VI$ often used peak p.d. or the p.d. across only one resistor. There was also further confusion about resistance.

Q7(b)

Candidates were most likely to score marking point 1. Other marking points were not often seen. Although responses included statements approaching the correct point, the statements were usually not quite correct, e.g., the voltmeter “couldn’t be calibrated”.

Q8(a)

Most candidates had no difficulties in either calculation, although in a few responses the temperature difference was converted to kelvin.

Q8(b)(i)

This question was generally done well, although some candidates weren’t clear on which parts of the apparatus had to be heated to 100^{o}C.

Q8(b)(ii)

Another calculation that was generally done well.

Q8(b)(iii)

The most common mark scored here was for energy dissipated to the surroundings, followed by the comparison. Few candidates scored marking point 2.

Q8(c)

Most candidates scored this mark, although a few candidates thought that the apparatus could be lagged with aluminium foil.

Q9(a)(i)

Some candidates scored marking point 1 while others scored marking point 2. Each of these marking points were quite common. Few answers explained the link with the age of red giants - just saying that there were none. Some candidates discussed how the luminosity and temperature changes with age without success.

Q9(a)(ii)

A lack of detail in the statements made in many of the responses limited the marks that could be awarded. References to area instead of surface area, temperature and fusion with no reference to the core. In some responses Stefan's law was written down but not referred to.

Q9(b)(i)

This was straight-forward for some candidates, but others multiplied the logs instead of adding, and others equated log *k* to *mx*.

Q9(b)(ii)

Most candidates scored marking point 1 for correct values in the table. Candidates seemed unsure how to label axes on log graphs, and seeing responses with axes labelled correctly was rare. Scales were varied- many good ones, but there were still a surprising number with factors of 3. Some best fit lines were very poor because candidates made the decision to treat a point as anomalous without circling it to indicate this.

Q9(b)(iii)

Some candidates included units for *n*. If candidates manipulated the line to ensure it went through the first and last points, they could use these co-ordinates for calculating gradient. However, forcing the line go through these points doesn't necessarily produce a best fit line.

Q10(a)

As there was the potential for candidates to make points in (a) that relate to (b) and vice versa, this question was marked holistically.

When describing how to read the scale, so there was no parallax, the words parallel and perpendicular were often used incorrectly.

A few candidates focused on accuracy and precision instead of the experiment.

Q10(b)(i)

Although the question states that there was systematic error due to reaction time and asks for another possible systematic error, many candidates just stated error due to human reaction time. Perhaps candidates thought that the reaction time mentioned in the question was something other than human reaction time.

Q10(b)(ii)

This was generally well answered, as most candidates were aware that using light gates removed reaction time errors, but that there are complications associated with using light gates to time an oscillation.

Q10(b)(iii)

Some candidates gave good clear answers. Some candidates however could not show that the gradient was $4\pi^2/k$.

Some candidates tried to substitute values for T^2 and m taken from the graph. This led to an incorrect value for k, as the best fit line does not pass through the origin.

In very weak responses, the intercept was read from the graph. These candidates possibly thought that k was the constant c from $y = mx + c$.

Q10(c)

The marking point awarded most often was marking point 3 for stating that repeating the measurement allowed a check for anomalies to be made. The idea of repeating and calculating a mean to minimise the effect of random errors was also seen in a number of responses.

A small number of candidates read the phrase "measured the time for 20 oscillations" to mean measuring the time for 1 oscillation 20 times.

Q11(a)

Some candidates used the Young's fringes formula, although the theory of this isn't even included in the specification. The distances given in the question were often used incorrectly, and it was clear that using a diffraction grating in a practical context was not well understood.

Q11(b)

Some candidates suggested the options given for marking point 1 in the mark scheme, but not many scored marking point 2. This was often because it was stated that the uncertainty (rather than the % uncertainty) would decrease.

In some responses, it was suggested that the diffraction grating could be changed, although such responses were not credited.

Q11(c)

This was aimed at the higher end of the grade range, and was poorly answered by most candidates. A few did manage a sensible explanation, although marking point 3 was rarely seen.

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