A-Level
Physics
7408/3BB

Report on the examination

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Introduction

This year's paper was more challenging than the 2024 paper.
Many students found the contexts harder and were able to make partial progress in many of the calculations.

While most students showed potential in core recall and interpretation tasks, a stronger foundation in the application of their knowledge and articulation of understanding would have led to higher levels of performance.

Question 1

1.1
Fewer than 15% of students gained two marks in this question.
Most students were able to draw the two rays refracting at the lens and meeting on the optical axis at the retina, but these often lacked any refraction at the air-cornea boundary. Others had the correct refraction at the air-cornea boundary but were unable to show correct refraction at the lens, typically drawing straight lines through the lens.

1.2
This was well answered with 75 % of students selecting the lens as the part of the eye that enabled accommodation.

1.3
This question discriminated reasonably well.
Fewer than 15% of students gained 4 marks; achieving this mark was indicative of a high-level of performance due to the student demonstrating their ability to perform this multi-step calculation.
Although this question was designated as a calculation, correct working was required to obtain credit for a value of d_1= 0.11(4) and for an answer of 19 (mm).
Many students struggled with this question. The most common error seen was the inability to use the amplitude accommodation due to being unable to recognise the value of d_2. Many made d_2 = 23 (that was inconsistent with A=8.8 D) and obtained a value for d_1 = 0.113.
Others used d_2=0.023 and obtained a value for d_1= 19.1 mm (which they presented as their answer). This yielded a number on the answer line that agreed with the correct answer but was obtained by incorrect means.
Fewer students realised that they had to use their d_1 to find the focal length at the new near point by using the lens equation with v=23 mm.

1.4
It was relatively easy to score one mark in this question with over 50% of students doing so. The first mark was available to students who described hypermetropia or referred to d_1's variation or A and d_2's variation.

To achieve two marks, the student had to explicitly describe how A and d_1 were related and how this relationship related to hypermetropia.
Lower achieving students mistook hypermetropia for myopia and discussed changes in far point with age.

Question 2

2.1
Students were able to access this question with 58% gaining two marks and a further 20 % gaining one mark.
Due to the nature of the 'show that', students were able to gain one mark for some partial working while being one step away from the answer.
2.2
This calculation proved to be very challenging with less than 15% of students gaining at least one mark.
Most students calculated 90% of their answer to Q2.1. They did not consider that some of this number will have decayed over the 24-hour period.
There were two methods that they could employ:

- In one method, (the intended method) they had to consider how many Tc had been produced and how many of these had decayed to determine how many remained to be extracted.
- In the second method, they could use the activity of the Tc after 24 hours and the decay constant to determine the number of Tc nuclei present. But even this more direct method meant having a well-developed ability to analyse Figure 3 and choose the correct decay constant for Tc (which they had to work out from knowing that Tc has a half-life of 6 hours).

Some students realised that the activity of the Tc was important but divided this activity by the decay constant for molybdenum.
2.3
Over 35% of students gained at least 4 marks. Most of these students were able to provide answers that addressed area 1 and area 3 of the mark scheme.
Many students restated information given in the question without adding any further detail.
Many were not sure what was meant by 'non-invasive' and stated TTE as being non-invasive but MUGA being invasive.
Many students confused the MUGA beta minus decay with a PET scan.
The quality of the language was often vague, with some students referring to radiation rather than ionising radiation.

Question 3

3.1
25 % of students gained two marks in this AO1 recall of what is meant by the threshold of hearing. However, 44% of students were unable to score any marks and typically referred to

the audible frequency range. 32% scored one mark for identifying the threshold of hearing as the minimum intensity that can be heard without referring to 1kHz.

3.2
This question discriminated reasonably well.
32 % of students gained 3 marks, with 23 % gaining 2 marks and approximately 24% gaining 1 mark.
Those scoring 3 marks typically had well-presented working that demonstrated the steps taken in obtaining the answer.
Most students scored at least 1 mark for reading off 78 dB from the graph where they had to contend with the frequency having a log scale. Some had difficulty with the read-off and incorrectly selected 82 dB or 74 dB; these students were still able to gain 2 marks by use of the intensity level formula or the power formula.
Many students multiplied their intensity level by their area, and this was not accepted for use of the power formula.
Those who did determine an intensity and use the power formula, quite often made an error in converting the area from 60 mm^2 to 6 x 10^{-5} m^2.

3.3
Almost 33% of students scored both marks for their sketch of the equal loudness curve.
Reasons for students losing marks typically included:

- the minimum intensity level outside of the allowed range of greater than 2 kHz and less than 4 kHz.
- mot passing through 1000 Hz, 100dB
- where they had a second minimum, its value had a lower intensity level than the intensity level at 3kHz.
- drawing a curve that intersected with the original curve.

Question 4

4.1
Typically, only higher performing students (approximately 13%) were able to relate the advantage of a small focal spot to the reduction of the penumbra in the image.
There were lots of vague statements that described this advantage as producing ‘a more precise / accurate beam’ without relating this to the improvement in the image of the bone.
Those who scored one mark in this question (approximately 40%) gained this mark for stating that having a focal spot that is too small would lead to overheating.

4.2
Approximately 30% of students did not score any marks in this question.
The answers were very vague and lacked details that would demonstrate the knowledge expected in this area of the specification.
Higher performing students typically gained at least two marks by being able to relate technical information to image production of the desired region without over exposure.

4.3

Just over 20% of students gained 3 marks in this question.

Approximately 20% scored 2 marks and this was typically for use of the half-thickness formula to calculate mu and use of the absorption formula to determine the decrease in intensity, using 27 mm as their thickness.

Some students thought the absorption formula produces the ratio that is absorbed instead of the ratio that is transmitted and proceeded to subtract their ratio from 1.

Conclusion

The multistep calculations in this paper challenged a significant portion of the students who sat this paper. Their answers frequently had omissions, conceptual errors and numerical errors.

Definitions and subject-specific terminology often lacked the precision required from A Level students.

The diagrams and graph-based questions often lacked the critical features required for full credit.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

