AQA
Questions matter

A-level
Physics
7408/3A

Report on the examination

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General comments

All parts of the 2025 paper were accessible and the paper is about 1 mark easier than in 2024. Both the mean mark and the standard deviation were higher than in 2019, which we identified at the time as setting the standard we wanted to maintain.

There were several instances such as 01.3 and 03.1 where students needlessly penalised themselves by truncating final answers. In 04.2 some otherwise excellent answers were spoiled by the unnecessary addition of a significant figure on the answer line.
Students must accept that whatever they put on the answer line is what the examiner uses to judge the work.

Stronger students were able to confirm their ability in AO3 parts 01.5, 02.5, 04.2 and 04.5 where they had to think more imaginatively about the problems.
The better-prepared knew how to deal with AO1 parts 02.1, 02.2 and 04.1 that tested familiar practical procedures, but the struggles of others suggest they may have had limited opportunities to carry out practical work.

The maths skills utilised in the AO2 parts 01.3, 02.3, 03.1 and 04.4 were mostly sound and particularly strong in 02.4 where we saw a lot of completely correct solutions that were easy to follow. Less well-organised students tended to have multiple threads to their arguments and spread their work haphazardly across the answer space; their grip on the algebra tended to quickly fall apart.

Most students showed their working and, in several parts, e.g. 01.3 and 04.4, we saw evidence to award 1 mark even when a final answer could not score. AQA expect that when the command words *Deduce* and *Determine* are used, correct working must be shown, whereas for *Calculate* only the final answer is required. It is recommended that working is shown at all times, however.

The students found lots of things in the paper that they could do.
In parts 01.4 and 01.5, many determined accurate values for the periods of the waveforms and could then show that Figure 2 confirmed the expected result of doubling m.

Parts 02.1 and 02.2 required careful explanations, but many correctly identified the ideas we wanted and avoided the generic responses that we have often seen previously.

Part 02.4 was usually answered particularly well. Most students could manipulate the equation for T then determine values of C and R_1 using Figure 4.

We noticed in 2024 that students are often good at deriving the SI units for a quantity, and in part 03.1 many identified the correct unit for α. We saw some examples of excellent work for part 03.4 and most realised that they should produce a logarithmic plot. However, the majority found 03.4 very testing. Very few observed the convention for labelling the axes of the $\log$ scales. We expect a (solidus) separator between the quantity and unit. The unit must be shown in the label because it affects the placeholder in the value. Brackets were usually missed; these are required because the $\log$ of a value is just a unitless number.

We expect that a set of derived data should usually have the same number of significant figures, but log values are different. Log values should be to the same number of decimal places; the first figure is not significant because it is a placeholder.

There was a wide variation in the quality of the graph work but better students saw that a false origin was needed to produce an effective scale for the log T axis. Few used difficult intervals along their scales but some used values such as 2.98, 3.08, 3.98 etc. We prefer not to see this as it makes interpretation difficult.

In part 01.1 many struggled to correctly identify two control variables. We saw too many suggestions such as 'use the same string'; we expect control variables to be quantitative in this situation. We also saw 'keep the frequency constant'; the first few words of the question established that frequency was the dependent variable.

In 2024 we found that most could read a micrometer correctly, but in part 04.1 many students struggled with the microscope scale. We noticed that some thought the reading in Figure 10 was between 24.5 and 24.6, presumably using the left-hand end of the vernier rather than the position of the zero.

Students knew what a fiducial mark is, but in part 04.3 only those who identified **B** could get a second mark for explaining their choice. We did not accept '**B** is at the equilibrium position' since each of the four positions shown in **Figure 12** was level with a point on the test tube that was in equilibrium. Only part 04.5 proved harder than 04.3. Students found the easiest parts to be 03.3 and 04.4.

Paper 3A draws on material found in Section 3 and Section 8 of the specification but centres should also review the Mathematical requirements outlined in Section 6 and refer to the relevant material in the Physics Practical Handbook.

Question 1

This question was about an investigation of how the frequency of a stationary wave on a string varied with tension. The main ideas tested were

- identification of the control variables in required practical activity 1 (specification reference 3.7.5.5 and 8.3.2 PS2.4)
- use of an oscilloscope as a voltmeter and as a clock (3.7.5.5)

In part 01.1 what should have been a straightforward opening question proved tricky and only 17% obtained both marks. No credit was given for a careless annotation to Figure 1 to identify the length of string that should be controlled.

In part 01.2 just under 50% correctly identified that m has a maximum range of 170 g.
Part 01.3 was a bit mixed, although many could determine the peak voltage and divide by root 2. For the second mark we wanted a voltage between 13.0 and 13.2, so a 2-sf answer was not accepted.

For part 01.4 nearly 70% correctly determined the period although a few thought that the time-base setting of 20 ms div^{-1} referred to minor divisions, thus getting about 530 ms. Here as elsewhere, some lost a mark, thinking they should round their 106 to 110 (mistakenly claiming this was 2 sf).

A majority saw the intention of part 01.5 and made the expected quantitative comparison between the waveforms in Figure 2.

The students who misinterpreted the time-base in the same way as above got about 375 ms and were not penalised. A few students took the novel approach of comparing the number of horizontal divisions for one cycle of each waveform. This was a valid idea and was not penalised.

Question 2

This question was about a variable frequency oscillator circuit.
The main ideas tested were

- ways to reduce or remove random and systematic error (3.1.2 and PS 2.3)
- calculation of percentage uncertainty from a set of tabulated data (3.1.2)
- understanding of the $y = mx + c$ idea (6.4 MS3.3)

In part 02.1 the preferred answer was that measuring $20T$ reduced the percentage uncertainty in T. We also accepted the idea that this reduced the effect of random error.

On 02.2 we expected the idea that repeating $20T$ enabled anomalous results to be identified. We do not accept the suggestion that measurements are repeated to mitigate the effect of anomalies. This implies that suspect readings should be included in the averaging process, but we want students to understand that anomalies, once detected, should be eliminated.

We assumed that students would make short work of part 02.3 but this was not the case. We saw quite a few invented solutions and some students did not use all the data in Table 1 despite being told that all were valid. Some used 0.01 as the uncertainty rather than calculating half the range.

In 02.4 there were two approaches to how Figure 4 should be used. Most determined the gradient and intercept while a minority substituted values from two points on the line into simultaneous equations.

The most common error, and the principal reason why many scored 4 out of 5 marks, was using R_2 in kΩ in the gradient calculation, leading to a power of 10 error in their C. Another reason for 4-mark answers was the truncation of their C result to 4×10^{-5}. Regardless of the type of error in C we allowed an error carried forward if this impacted the result for R_1. Inadequate presentation such as use of a similar looking 'C' for the unknown capacitance and for the vertical intercept undermined some efforts.

In part 02.5 most correctly identified that R_2 should vary from 1 k to 11 k but less than 20% could suggest a suitable circuit. Students often said they would *combine* a fixed and a variable resistor, but they needed to say these would be connected in series.

Question 3

This question was about an investigation of how the filament resistance of a lamp varies with temperature. The main ideas tested were

- deducing the SI unit of a quantity (3.1.1)
- use of logarithmic plots to test a power law variation (6.4 MS3.11)

In part 03.1 the truncation of a valid answer for α to 2 sf cost a mark, however the identification of the SI unit discriminated well.

In 03.2 over 90% obtained the first mark for explaining how to determine P but could not say enough to get the second mark. Suggesting the use of Figure 6 to obtain T did not get credit.

In part 03.3 nearly all identified P = 5.0 (top left) and P_2 = 5.2 (bottom right). Fewer got the middle row correct, sometimes swapping the P_1 and P_2 values and others wrote P = 12.8. Most determined the missing P_1 value but lost the mark for rounding to 1 dp.

Part 03.4 defeated the less successful students who didn't understand that they should use a logarithmic plot to identify n. These students usually plotted a graph of P_1 against T. Despite producing a valid gradient result, many did not write an integer on the answer line.

Students were told that to determine the value of the integer n they should plot a suitable graph, so we did not credit answers that used tabulated data to determine n. Even so, 12% were able to score the maximum 5 marks.

Question 4

This question was about the vertical oscillations of a loaded test tube in a liquid. The main ideas tested were

- use of vernier scales (8.1 ATe)
- comment on experimental design (7.3.2 PS2.1)

In 04.1 most correctly determined that there were 13 turns of the string between points **P** and **Q** but then could not make progress because they could not read the vernier scale. In 04.2 few took account of the thickness of the string in their calculation but over 50% obtained two marks for calculating an appropriate length for their number of turns. Some very good answers did use their string thickness but then did not record the length of string to the nearest mm.

In 04.3 less than 50% correctly identified position **B** as the correct position for the fiducial mark. 04.4 was a simple problem and over 60% got fully correct answers.

Part 04.5 presented a tricky problem. Many realised that to produce more oscillations the initial amplitude should be larger. However, the test tube was already in contact with the bottom of the beaker as it was released. This tempted some to suggest using a deeper beaker but that would not change the depth of the test tube when at rest. Others thought the beaker could be made narrower which would increase the depth at which the test tube floated, however that would increase the drag on the test tube due to the proximity of the walls. Therefore, to increase the initial amplitude the only available solution was to add more liquid.

Many said that reducing drag would make the oscillations die away more slowly but there was very little they could say to explain how they would achieve this. Changes to the test tube or to the liquid would change the period and the question said that was not allowed.

Mark Ranges and Award of Grades

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