AQA

Questions matter

AS

Physics

7407/2 Paper 2

Report on the Examination

7407
June 2024

Version: 1.0

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General comments

Section A assessed practical skills in two contexts. Question 2 provided a less familiar context than question 1, even though routine skills were being assessed.

The context of question 3 in Section B was far more accessible to students than that of question 4. In question 4 many students struggled to identify the relevant Physics.

Students, on average, achieved better success in Section C than in Sections A and B. However, a large number of questions in Section C had a greater number of popular distractors chosen than correct keys. There was an increased number of non-attempts towards the end of Section C, indicating that some students may have run out of time.

Section A

Question 1

01.1 Approximately 80% of students gained this mark by showing sufficient working. A common error was to treat one of the values as an anomaly.

01.2 This question discriminated well. Many students gained 1 mark through using an incorrect number of cycles. The most common incorrect value seen was 2.5 cycles.

01.3 Success in this question was achieved by approximately half of the cohort. A final answer to two significant figures was condoned in this series, but only when processing showed some use of a value in millimetres.

01.4 Nearly 50% of students gained full credit for determining the acceleration using their values of displacement and time. By far the most successful route was to use $s = \frac{1}{2}at^2$. Students who calculated a speed using $v = \frac{s}{t}$ commonly failed to appreciate that this was the mean speed.

01.5 There was very low success for this question which was about the uncertainty in a measurement. Many students gave rote answers that did not address the context. References to rulers were common. The best responses explained why the resolution of the graph paper led to a 1 mm uncertainty in one reading and then stated that the measurement was based on two readings and therefore the two uncertainties needed to be added.

01.6 Students found this question surprisingly difficult with only about one-sixth of the cohort gaining both marks.

01.7 Students found this combination of theory and practice to be extremely challenging. Many suggested that the experiment had been performed in the absence of friction, rather than appreciating that the analysis ignored friction. By this logic, students argued that friction would reduce the acceleration and so the value of *g* would be smaller. A common misconception was that the value of *g* would be less than 9.81 m s^{-2} because the trolley was not falling vertically.

Question 2

02.1 Just over half of the students gained this mark. Misuse of units for length was a common error.

02.2 This question could be tackled either graphically or numerically. There was an even split in the approach taken by students. In the graphical method, a common mistake was to misread the 1.55 mm line as 1.60 mm. The frequent mistake in the numerical method was (as in 02.1) misuse of units.

02.3 Students often calculated a correct value for *h* but then concluded that result could not be obtained because the scale for *h* ended at 3.5 mm, or similarly that the hardness of 5 could not be plotted because the scale for *B* only went down to 20.

02.4 Approximately 42% of students gave a valid answer. 'Vernier caliper' was by far the most common incorrect response.

02.5 Most students addressed either marking point one or marking point three; very few considered marking point two which dealt with the repeat readings and mean value. Marking point one, about the reduced percentage uncertainty, was the response seen most commonly. Students found the idea of marking point three difficult to express. A frequently seen phrase was "*d* was easier to measure because …" without any technical development. A common misconception was that *d* was a constant value. Students here confused the diameter of the sphere with the diameter of the indentation.

Section B

Question 3

03.1 Nearly 50% of students gained both marks. About 25% achieved one mark, usually for using the total mass of the cables rather than the mass of one. One purpose of this question was to establish that the mass of the cables was significant, a point that needed to be considered in 03.2.

03.2 This question discriminated well with a large majority of students gaining some marks. The mark scheme allowed credit for the separate cognitive steps involved. A significant number of students who gained three marks were unsure what value of mass to use with their resultant force. Another point of confusion related to the maximum tension. The mass of the cables is significant in this context, so the maximum tension is at the top of each cable.

03.3 False comparisons (eg 167 MPa < 890 MPa) or absent conclusions were the main reasons for students failing to gain full credit here. An explicit conclusion is necessary for complete credit in this type of question. For example, "167 × 3 = 500 MPa, which is less than 890 MPa, so the system is safe".

03.4 Nearly 60% of students gained some credit here but about 25% made no progress. The most common error was working in mixed units of energy, for instance adding values in MJ to values in kW h. A frequent misconception was that powers could be compared. Some students struggled to identify the correct times on Figure 12.

Question 4

04.1 Most students achieved little success in this question about constructive interference. Many struggled with the meaning of "relationship" and often gave an answer in terms of a correlation, eg "as *d* increases …". Answers that invoked the equations for a diffraction grating or two–source interference were frequently given, with no connection to the physics of the arrangement.

04.2 About 22% of students gained both marks with a further 35% or so gaining one mark for using an incorrect fringe spacing. The common mistakes were to omit the factor 2 when rearranging the equation or to convert prefixes incorrectly.

04.3 Most students incorrectly responded to this question with a Snell's law approach and argued in terms of a changing angle of refraction causing a change in the fringe spacing. This was incorrect as the lights rays are almost incident along the normal to the plates.

Students who gained one mark made a relevant statement about the decrease in wave speed or wavelength but did not clearly reference the constant frequency. It was surprising how many students, having appreciated that the wavelength decreased, did not use the equation to deduce the consequential decrease in *s*.

Section C

Generally, students were more successful in answering questions 5, 6, 7, 11, 14, 17 and were less successful in answering questions 9, 10, 12, 13, 15, 16, 18, 21, 22, 23.

For the following questions, the most popular response was not the key. A possible reason for this is given for some questions.

Question 9: Option C (120 Ω) was the most popular response. This corresponds to 480 Ω divided by 4 (from $\frac{8.0}{2.0}$).

Question 10: Options A, B and C were equally popular.

Question 12: Option B (8.0 W) was the most popular response. This is likely to be from multiplying the mass of water per second (2 kg) by the speed (4.0 m s^{-1}). This question also had a large number of non-attempts.

Question 13: Option C (8.0 V) was the most popular response. This arises from arriving at a potential difference of 2.0 V for the initial state and then reasoning that p.d. increases by a factor of four in line with the increase in power.

Question 15: Option B (10 cm) was the most popular response.

Question 16: Option A ($u\bar{s}$) was the most popular response. This is the quark structure of the K^+ meson.

Question 18: Option C (2) the most popular response.

Question 21: Option B was the most popular response.

Question 22: Option C (15 N) was the most popular response. This is obtained using a change in velocity of 5 m s^{-1}.

Question 23: Option B (30 m) was the most popular response. This is half the circumference, not the diameter, which is the correct answer.

Question 30: Option B was the most popular response.

Mark Ranges and Award of Grades

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