AQA

A-level
PHYSICS

7408/1 Paper 1
Report on the Examination

June 2017

Version: 1.0

Further copies of this Report are available from aqa.org.uk

General

This was the first examination at this level for the new revised A-level Physics specification. There is a greater weighting for Assessment Objective 3 which requires judgements to be made and conclusions reached. Questions of this nature tend to be of high demand and evidence from their responses indicates that a significant proportion of students were able to produce confident answers; they acquitted themselves well. There is also a greater emphasis on more extended calculations and it was encouraging to see many students coping successfully when a detailed quantitative analysis was required. Students generally gave extended answers which were clearly set out, exhibiting a logical structure.

Question 1

This question was generally well answered. In question 01.1, students had to complete the electron capture equation. While the majority were able to correctly identify the mass number and atomic number for argon, they were less successful at identifying the electron neutrino, with responses giving the particle as a neutron or gamma photon being quite common.

Identifying the fundamental interaction involved as the weak interaction proved to be very accessible and over 80% of students were able to do this. They were less successful, however, in giving a reason. This was mainly because they did not refer to the interaction shown, giving answers which only mentioned leptons. They either needed to refer to the change of quark, or state that the interaction involved both hadrons and leptons.

The calculation in question 01.3 was well answered and over two-thirds of students scored full marks. The common errors for those who did not were either failing to convert energy to joules, or a power of ten mistake.

Question 01.4 was an example of students being required to make a judgement, and many good responses were seen. A significant proportion of students did, however, give generic answers indicating how they would distinguish between alpha, beta and gamma decay. This did not answer the question which required them to state what interaction was occurring to produce calcium–40 from the potassium isotope.

Question 2

Question 02.1 required students to analyse the data given and demonstrate that it was consistent with the given relationship. Just over half of students were able to do this. Common errors were confusion between linear and proportional relationships, and attempts to derive the expression algebraically without using the data.

The calculation in question 02.2 proved to be one of the more challenging in the paper. The main reason for this was a lack of appreciation of how to find the mass per unit length of the nylon string; this did limit them although they were able to pick up a mark for a correct substitution of tension and frequency in the appropriate formula.

The explanation, required in 02.3, of why the result might be different if much larger masses were used, was not well answered. The majority did not appreciate that the nylon would get thinner and this would reduce the mass per unit length. Common responses tried to invoke Hooke's law notwithstanding the fact that nylon does not obey this law.

Question 3

The first two parts of this question on refraction proved to be straightforward, with three-quarters of students scoring full marks. The third part, which involved a certain amount of judgement, was less well done. Many students mixed up the blue and red light, stating that the red light would undergo total internal reflection. Some did pick up on the fact that if the refractive indices of both media increased by the same proportion then there would be no change and all three rays would follow the same path. This approach received full credit.

Question 4

A quite detailed circuit analysis was required for this question and some very impressive answers were seen.

In question 04.1 the commonest reason for losing a mark was a failure to indicate that the gradient of the graph gave the negative value of internal resistance. Identifying which circuit would be suitable to power the road sign involved a detailed analysis; while over a third of students were able to do this successfully, a significant proportion of these then failed to score the conclusion mark because they did not state clearly that the circuit in Figure 6 was suitable because it provided a current greater than 75 mA. Less able students struggled when dealing with the series and parallel combination of cells. Of those who could correctly identify the combined internal resistance as 12 Ω, few were then able to give the combined emf as 1.4 V.

The analysis of the circuit in Figure 5 was much more straightforward and nearly 80% of students were able to do this. There are of course alternative approaches to the analysis and any correct method was given full credit.

Question 04.3 involved an efficiency calculation. A large number of students were able to calculate the useful power output but a surprising number did not deal with the 4.0% efficiency correctly. It was quite common to see the input power multiplied by 0.96 rather than divided by 0.04. There were also, as is frequently the case, power of ten errors when dealing with the surface area.

Question 5

Responses to this question on statics proved to be quite patchy.

Question 05.1 was generally well answered, with the majority appreciating that friction was negligible because the resultant force was a right angle to the wall.

Question 05.2 was less well done: very few students appreciated that the arrow for force G, the weight and the resultant force from the wall when extended would intersect at one point. G was often drawn vertically upwards or along the ladder; this did score 1 mark providing the arrow started from the point of contact with the ground. The calculation caused problems for over half of the students because they did not appreciate that they had to apply the principle of moments. The last part of the question generated some very good answers with some quite detailed analysis seen. Three-quarters of students were awarded at least two marks. There were some misconceptions such as that the force G decreases as the person climbs the ladder or that the resultant force from the wall only increases when the person is over half-way up the ladder.

Question 6

The responses to this question showed significant variation with students performing significantly better in the quantitative parts than they did in the qualitative.

The majority of students failed to identify the forces acting on the trolley that were parallel with the slope. It was rare to see the component of the combined weights of trolley and blocks identified. Also, the majority of diagrams included forces which were not required such as the reaction force.

Question 06.2 involved an algebraic derivation of the acceleration of the trolley – this proved quite a challenge for some and responses had to be scrutinised carefully to see if they were valid. Many provided a correct formula for the resultant force on trolley A but then incorrectly stated that the tension was equal to the component of trolley B's weight along the slope. The more successful answers treated the trollies as a system with a resultant force acting equal to (M+2m) gsin35 – Mgsin35 and a combined mass of 2M +2m.

There was a typographical error in question 6.3 which led candidates to assume that loaded trolley A was being compared with loaded trolley B. The question originally intended to ask students to compare loaded trolley A with unloaded trolley B (as shown in Figure 8). We judged that both interpretations should be allowed and revised the mark scheme to permit the two different approaches. Either approach could achieve 0, 1 or 2 marks according to the accuracy of the answer. Student responses to this question were carefully scrutinised to assess the impact of the typographical error, and there was no evidence that students were unable to generate meaningful responses to this question.

The conclusion mark of how the momenta compared was then conditional on the first mark being awarded. The multi-step calculations in 06.4 and 06.5 were well done, with a high proportion of students scoring at least 3 of the 5 marks available.

Question 7

Question 07.1 was an extended calculation and 60% of students were able to calculate the mass or spring constant. The 'consequential error' principle was applied and so an incorrect value could be used to calculate the other value for full credit.

The next part also resulted in many good answers and although students did not need to use their values, full credit was given for correct calculations using calculated mass and spring constant, even if one or both of these were incorrect.

Question 07.3 required students to identify two differences that would occur when the mass attached to spring B oscillated in oil. Identifying the differences proved to be straightforward but giving the reason for this far less so. The most common difference given was the decrease in amplitude, with the next most popular being the shift in the peak amplitude to a higher frequency.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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