A-LEVEL
PHYSICS

7408/1

Report on the Examination

7408

June 2022

Version: 1.0

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General Comments

In terms of demand and specification coverage, this paper was very similar to those of previous series. The questions gave students many opportunities to demonstrate their knowledge, skills and understanding across a range of topics. The paper included a variety of question types, including short answers, single and multi-step calculations, extended writing and multiple choice.

The paper produced a good spread of marks with all students being given the opportunity to show the level at which they are working.

Question 1

Most students achieved both marks on 01.1. Students who wrote '*a*' for the alpha particle did not receive credit. Several students also included other particles, such as neutrinos, in the equation.

01.2 proved to be much more challenging. Most students were able to access the first mark, but few went on to explain fully why the boson was the W^-, often missing out any consideration of the significance of the charge.

01.3 required students to set out the evidence clearly, linking it to the particular element being discussed. Although it was not penalised, many students discussed whether the lines of hydrogen or sodium matched those of helium, rather than the other way around.

Both 01.4 and 01.5 discriminated reasonably well, each producing a spread of marks.

The calculation in 01.4 was correctly completed by most students. In a significant number of wrong answers there was an attempt to calculate an energy difference which lost credit. Answers that were based on a difference in wavelengths were penalised further.

01.5 proved to be more challenging. Answers were often vague or ambiguous. Important details related to the role of the photon, or the significance of energy levels, were also often missing. Rather than simply explaining emission, several students explained how the excitation happened in the first place, and this often led to confusion.

Question 2

02.1 and 02.3 were answered correctly by the vast majority of students.

Most students found 02.2 very challenging. An important aspect of the question was that there was a fixed amount of energy released in the process; this point was often missed. The confusion in many answers demonstrated that few students understood what the graph was telling them.

02.4 produced a good spread of marks and discriminated very well. Most students were able to pick up one mark for the energy calculation. Fewer went on to work out explicitly the energy of one photon. Fewer still saw that this was a minimum energy as it assumed that the particles were stationary.

Question 3

Most students were able to answer 03.1 correctly and obtain full marks. Partial credit was available for students who got the wrong answer, but answers needed to be set out with sufficient clarity for any mark to be awarded. Students should be encouraged to make each step in their calculations clear.

The relatively poor performance of students in 03.2 and 03.3 demonstrated much misunderstanding about the components of forces. It was made clear in the question that the tension in the rope was the same throughout, but many students showed little awareness of this.

The moment calculation in 03.4 proved to be much more accessible. Partial credit was available to students who made one error in their answer.

There were many alternative answers to 03.5 and all of them were given credit. Students often failed to gain marks by making vague statements that failed to set out clearly the physics behind their suggestions. Several students suggested, incorrectly, that shortening the rope so that A was higher would make a difference.

Question 4

04.1 was very straightforward. This was a 'show that' question and students failed to gain marks when they did not make it clear what they were doing by setting out the equation and substituting the data.

04.2 was much more challenging. There were several creditable approaches, with much opportunity in the mark scheme for partial credit. This was only given when it was clear what the student was doing.

04.3 was much more accessible. Most students were able to give a complete answer with only powers of ten errors causing problems for some in the final mark.

Examiners expected 04.4 to be answered very well. However, a significant number of students could not get beyond the idea that the resistance of the variable resistor increased. At A-level, students are expected to be able to answer an electricity problem of this kind without a circuit diagram, but many students were unable to work out what was going on without it.

A major difference between problems on electricity at A-level and GCSE is the consideration of internal resistance. Correct answers for 04.5 were extremely rare, and answers to this question demonstrated many of the misconceptions students have about electricity. A significant number of students have clearly not moved beyond the idea that '*electricity follows the easiest path*'. Many answers to this question were confused, ambiguous and contradictory.

Question 5

The question was based on a practical demonstration of the relationship between simple harmonic motion (shm) and circular motion.

The calculations in 05.1, 05.3 and 05.5 were very straightforward and caused little trouble for most students.

05.2 was more challenging. Examiners were lenient in their interpretation of the arrow, but several students lost the mark through carelessness. When drawing a direction such as this students should use a ruler and avoid ambiguity in the construction.

In order to answer 05.4 correctly students had to be clear about the evidence on which their answer was based. Stating that the velocity is changing, without any mention of direction, was not interpreted by examiners as evidence. Many students invoked Newton's 3rd law without success.

Answers to 05.6 were often incomplete. Examiners were expecting to see a comparison, but many students only discussed the effect on the pendulum. In order to gain the phase mark some supporting discussion was needed. This was partly because both no change and an in-phase change were acceptable, depending on the depth of the student's discussion.

Question 6

This question on refraction proved to be reasonably discriminating and produced a good spread of marks.

In order to earn the mark in 06.1 students had to make it clear why a ray bending away from the normal indicates an increase in refractive index. The best answers were supported either by a discussion of Snell's Law or by a consideration of the change in speed.

The calculation in 06.2 was more straightforward but many students struggled to identify the angle of incidence. Rounding errors were also relatively common.

It is clear from the rubric to the examination paper that students are expected to have a protractor. It is expected, therefore, that students should be able to draw reflected rays accurately. Many students realised that total internal reflection was taking place in 06.3, but drew rays that were obviously incorrect. This question discriminated very well, with only the most able students likely to get all three marks.

SECTION B

The easiest questions were 13, 16, 8, 17, 10, 31, 15 and 11.

The hardest questions were 21, 25, 27 and 26. All these had distractors that were more popular than the correct answer.

In question 21 the most popular answer by far was A, the maximum order visible. B was the next most popular, presumably because these students realised that there was also a central maximum.

Responses to question 25 indicated how poorly Newton's third law of motion is understood. The correct answer was the least popular option. Clearly many students do not realise that the pair of forces act on different objects and are the same type of force.

In question 27 all four options were similarly popular. It was clear that many students did not spot the word 'extra' in the question, for example.

Question 26 was a difficult multi-step calculation. Most students chose B, and the next most popular was D, the correct answer.

Mark Ranges and Award of Grades

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