A-LEVEL
PHYSICS

7408/3BD – Turning Points in Physics
Report on the Examination

7408
June 2022

Version: 1.0

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

General Comments

In terms of demand and specification coverage, this paper was similar to those of previous series. The questions gave students many opportunities to demonstrate knowledge 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 of their work.

Question 1

Most students were able to pick up one mark in 01.1. This was often for mentioning the absence of diffraction in the images. Fewer students obtained both marks, with the point that corpuscles were postulated to travel in straight lines being missed frequently.

Although most students were able to pick up a few marks in 01.2, answers of high quality were rare. The changes that had to be made to the arrangement usually lacked detail, with only one or two points being mentioned. The descriptions of Huygen's wavelets were vague and incomplete, with many students demonstrating little understanding of what the theory suggests. The explanations of the pattern were often based on basic core knowledge with little more than references to constructive and destructive interference, and with no mention of how the waves combined. Many students also confused path differences and phase differences in their discussions.

01.3 proved to be similarly challenging. The fact that the arrangement drawn would not produce sharp shadows was missed by most students. The best answers gave diagram annotations that showed the paths of the corpuscles extending beyond the area directly below the gaps. This omission meant that comparisons with Huygens based on diffraction alone rarely gained credit, as both Newton and Huygens would predict a shaded area around the central bright spot. Answers were often limited to some idea of a pattern of fringes around the bright centre, with some discussion of separation of colours.

Question 2

The best answers to 02.1 annotated the diagram to show the directions of the forces on the droplet and made correct reference to the direction of the electric field. Often answers were vague, with little attempt to describe the equilibrium position, with terms like '*counteract*' being used to try to give some sense of the relationship between the weight and the force due to the electric field.

The calculation in 02.2 proved to be much more accessible with most students being able to gain all three marks. Partial credit was available for incorrect answers, but the quality of presentation made some students' work very difficult to follow.

Having the relationship to aim for was a mixed blessing in 02.3. It was clear that many students attempted to work backwards but, without a clear indication of the difference between the two velocities, these approaches did not gain credit.

Despite being directed to use the equation in 02.4, many students attempted to work out Q from first principles. Most students who correctly determined the charge on the oil drop spotted that it was a multiple of the electronic charge.

In order to obtain full marks in 02.5 students had to have a clear argument about the relationship between the viscosity and the charge. The most commonly missed mark was the second, which required some clarity about how the mass or radius of the droplet was determined.

Question 3

Many students gave a very simple answer to 03.1 without any consideration of the significance of the frequency in that equation. Complete answers were rare.

In 03.2 many students simply worked out a speed and made a comment about how close it was to the speed of light, giving little consideration to the question itself. The best answers compared one of the properties of the experiment with what it would have to be in order to measure the speed of light. The frequency was the most common parameter, but the path length or number of teeth were also discussed by some students.

There is a statement (3.12.2.3) in the specification about the permittivity and permeability constants. It was clear in 03.3 that many students had very little idea about how these are related to the properties of an electromagnetic wave and therefore the speed of light.

Question 4

Most students correctly identified the graph in 04.1.

04.2 proved to be much more challenging, with some students attempting to use the non-relativistic kinetic energy formula and using a speed greater than that of light.

The relationship between energy and mass is an important one in relativity and in 04.3 examiners expected to see some awareness of the implications of that relationship. This was rarely seen, even in a basic form.

Mark Ranges and Award of Grades

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