AQA

A-LEVEL
PHYSICS

7408/3BB Medical Physics
Report on the Examination

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General Comments

Overall, students performed better on this paper than on the corresponding paper in 2017, the first Medical Physics paper set for the reformed specification. However, many students failed to provide sufficient detail, both in written and numerical answers. Nearly all students attempted all parts of the paper, suggesting that there was no problem with the time allowed.

Question 1

Part 01.1 was descriptive. Although the vast majority of students were able to name the two fibre bundles correctly, few were able then to explain their use well enough to gain full marks (16.2% gained all four available marks). The question required the students to name the bundle and link the fibre arrangement to the use of the bundle. Answers for the use of the coherent bundle such as “used to obtain an image”, “to form an image”, “see inside the body” and “it can image the inside of the body” were not awarded a mark. In a similar way, the answer for the use of the non-coherent bundle “used to transmit light” was not awarded a mark as both bundles transmit light.

Part 01.2 required a simple drawing showing how the refractive index varied from the core into air. It was a requirement to do a calculation to work out the refractive index of the cladding – good students did this well. When the calculation was not shown, the marks could still be awarded for accurately drawn lines on the diagram. All types of lines were seen from curves to slopes, but better students were able to draw the series of steps as required.

Question 2

The first part, 02.1, required the students to use the data provided to make a sensible comment on whether the eye could resolve two images on the retina. This could be done in many ways, but the final statement required a direct comparison between either two calculated values, or a comparison between a calculated value and data quoted in the question. In order to gain full marks, students needed to demonstrate that in order to ensure that two images could be resolved, the minimum distance between the two images was greater than two cell diameters. This point was missed by many students who either used one or three cell diameters as the limiting factor. Many other students could not use the data supplied in a meaningful way, with a surprising number trying to use the lens equation to work out a focal length. The mean mark on this question was 0.97 out of 4, with 8.7% of students scoring all four marks available.

Part 02.2 required students to sketch and label the response curves for the three colour cones of the eye. Although most students gained a mark for drawing three curves and naming the curves blue, green and red with increasing wavelength, hardly any gained either of the other marks for relative heights or range of wavelengths.

Question 3

This question required the students to discuss the basic principles of a CT scanner, to explain why a CT scan was advantageous for assessing head injuries and to explain why a simple X-ray procedure was more suitable for assessing other injuries. Their answers highlighted the lack of clarity in many students’ written work. Many failed to address the advantages of the CT scan for assessing head injuries and thus limited the mark available. A noticeable number seemed to have little or no idea of what a CT scan is and either wrote about an MR scan, or about injecting

radioisotopes and detecting the emitted radiation using gamma cameras. The mean mark on this question was 2.55 out of 6, with only 1.1% of students scoring all six marks available.

Question 4

Part 04.1 showed a suggested graph drawn by a student to show the response of a sound meter set to the dBA scale over a range of frequencies in relation to the curve for the dB setting, showing constant output power of the source. The students were asked to discuss whether the curve drawn by the student was correct. There were three main points which were wrong, the fact that the two curves did not cross at 1000 Hz, the fact that the peak of the dBA curve was not at 3000 Hz, and the fact that there was a 6 kHz plateau in the dBA curve. There were many good answers to individual errors, but few were able to put all the answers together and gain full marks. A noticeable number of students suggested that the dBA curve was upside down. The other noticeable error was the inability to read the logarithmic scale, suggesting that the peak of the dBA curve was 3100 or 3200 Hz. Unfortunately, just over 45% of students failed to score on this question.

Part 04.2 was answered well by many students, with over a quarter of them gaining all four marks. There were many ways to attempt this question and the examiners were impressed with some of the approaches used by students. The marks were awarded for different calculations which involved specific equations and a final mark for an adequate discussion comparing either the student's calculated answer with a value quoted in the question, or two calculated answers. The main source of error, which led to a two-mark penalty, was using the wrong formula for the area of a sphere when relating intensity and power. An error here was carried forward so that the remaining marks could still be gained.

Question 5

Part 05.1 required students to discuss why initial scans are important in deciding the best treatment of a patient with a tumour. This was a very open question, with many relevant points being allowed to gain credit. Over half of students did score all three marks, however many students were unable to write clear statements, often writing two opposite statements which cancelled each other.

Part 05.2 was a simple multiple choice question on the meaning of half-value thickness which the majority of students (76.2%) answered correctly.

Many students were able to do the calculation in part 05.3 (59.4% gained at least three marks). However, only a small number of students were able to state the correct unit for the mass attenuation coefficient.

Mark Ranges and Award of Grades

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