



A-level **PHYSICS**

7408/3BB Medical Physics
Report on the Examination

7408
Summer 2017

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General Comments

There was good evidence that students had attempted all the questions. As in the previous specification, most marks were lost where students failed to add the detail needed, or failed to answer the question asked.

Question 1

This question was on the defect of the eye and its correction.

In part 01.1 many students only provided one of the points needed. Students sometimes lost a mark by providing a correct answer and a wrong answer for the same point, for example 'the eyeball was too short or the lens was too strong'.

In part 01.2 it was pleasing to find few students who found ' u ', the object distance, rather than ' v ', the image distance. However, the units in the calculation proved to be challenging for many students. The power of lens in dioptres meant that object distance needed to be in metres in the calculation. The final answer then needed to be converted back to centimetres. The most common wrong answer was '0.51' which only gained 1 mark for the correct number of significant figures.

Part 01.3 proved to be difficult, with the majority of students thinking that it was 'the aided near point' rather than the correct answer of 'the unaided near point'.

Part 01.4 required a ray diagram to be drawn, which a significant number of students were unable to do. Students should be aware that when using a correcting lens, objects are always real and images are always virtual. The majority of diagrams showed the formation of a real image. Many students also failed to score the labelling mark for correct labelling of object, image and a correct principal focus. The students who were able to draw the correct ray diagram were, in the main, also able to correctly label the diagram.

Question 2

This question was on the dangers of X-rays and the use of ultrasound.

Part 02.1 was an open text response part which considered the danger of X-rays and how the danger was managed for a simple X-ray of a suspected broken arm. Most students were aware of the danger and were able to explain the possible result of cell damage and the formation of cancerous tumours. However, the discussion of three methods for limiting the danger often lacked relevance and explanation.

Irrelevant answers often seen included use of fluoroscopic imaging with a barium meal, and details of the rotating anode which allowed the anode to emit X-rays in only one direction. There were many who stated that the patient needed to be covered by lead sheets. Where students had an understanding of the situation, some good answers were seen, but these were few in number.

Part 02.2 asked students to explain whether X-rays or ultrasound would be best to investigate a suspected fault in the aorta as it passed through the abdomen. Some students failed to read the

question and wrote about imaging the heart, stating that ultrasound could not be used as it would have to pass through the ribs. When students were discussing the correct situation, many failed to gain the mark for stating that ultrasound gave better definition between different tissues and blood. Having pointed to the dangers of X-rays in the first part of the question, it was noticeable that many students failed to state that another reason for using ultrasound was the fact that it produced no known adverse effects on the patient.

The last part, 02.3, was a calculation of acoustic impedance. The information given in the question required the student to use the negative value of a square-root in order to complete the calculation. This was rarely seen. Students who used the positive root and then completed the calculation correctly were given 3 out of the 4 marks available. Other errors were seen, examples of which were not converting the percentage to the correct number, not rooting the value and calculating the wrong acoustic impedance, Z_1 rather than Z_2 .

Question 3

This question was on a new part of the specification, PET scans.

In part 03.1, a common answer was ‘a radioactive isotope’, which gave no additional information and could not be given the mark.

Part 03.2 was well answered by many students. A common incorrect response was the complete line which started with $\frac{1}{T}$, and then continued with a series of equal signs to 68.9 with no indication that this was in fact T .

Part 03.3 asked for some discussion as to the suitable time the patient may be left to relax. As the question stated that the isotope was injected into the blood, credit was focussed on clear reference to the isotope being carried around the body in the blood stream.

Very few students suggested that time may then be needed for the part of the body being investigated to take in the isotope. The most commonly awarded mark was for some sensible link between the time to relax and the effective half-life. This question revealed some fairly common misconceptions about the term *half-life*.

Many stated or implied that a scan could not be performed after one half-life had passed, whilst others suggested that no decay would occur until this point. Some students used technetium-99 as the isotope, quoting a half-life of 6 hours, when they were told previously that the half-life of the isotope being used was 110 minutes.

Part 03.4 on the process on annihilation was well answered with many students getting both marks.

Part 03.5 on the time delay between photon detection provided many good answers. The maximum delay was worked out as 6.7×10^{-10} s by most students, but some students were not able to suggest that the minimum time delay was in fact 0 for gamma photons produced in the centre of the head.

Question 4

This question was based on ECG traces.

Part 04.1 proved difficult. The labelling of the potential axis caused most problems with many students failing to put the 0 for the scale in the correct place. However, the scale on the time axis also caused problems. A common mistake was to place a number at the end of an axis without another number on the axis to provide a point of reference. For example, the sole number 0.8 at the right of the time axis did not gain credit.

Part 04.2 required students to look at the noise on the trace and suggest reasons for that noise. Answers such as “the skin had not been cleaned”, or “dead skin and hair had not been removed”, were treated as neutral answers, but with the inclusion of “resulting in the electrodes not being securely connected” the correct point was made and a mark awarded. Another answer which was felt to be too vague for the award of a mark was “the electrodes weren’t properly attached”.

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.