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Applied Science SC08

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Unit 8: Medical Physics

Report on the Examination

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General Comments

As usual, there were a large proportion of very well prepared students but a substantial minority who seemed to have very little knowledge or understanding of the subject.

There were still issues with mathematics, especially manipulating equations and even making correct substitutions. In question 6, a substantial minority of students did not answer the question that was asked. It might be useful to remind candidates to take the time to ensure that they understand exactly what the question has asked for.

On the other hand, students produced much better responses to the questions where extended answers were required. In particular, there was much better response to the question which required students to describe an experiment.

Question 1

(a) Most students gained full marks.

(b) Most students gained full marks for both parts. Responses that suggested that the radiographer would be dressed completely in lead-lined clothing were unrealistic and therefore did not gain credit for part (i).

(c) About half of students gained the mark for (i). Students suggested goggles as protection did not gain the mark unless it was clear that they did not mean normal laboratory safety goggles.

Question 2

(a)(i) Most students gained at least 2 marks. However, many failed to comment that the amount of expansion depended on the temperature increase.

(a)(ii) A surprising number of students did not identify conduction as being the heat transfer mechanism involved.

(b)(i) Generally done well, with most students gaining at least 1 mark.

(b)(ii) Most students gained 2 marks for identifying that heat from the body was reflected back to the patient. It was disappointing to see some students suggesting that air or cold were reflected by the silver. Many students did not identify that heat radiation/infra-red radiation was involved so failed to gain the third mark.

(c)(i) Most students addressed this well.

(c)(ii) Most students address this quite well. However, it was disappointing to see how many students stated that digital thermometers were more accurate than analogue which is not necessarily the case (though of course there is less room for human error when reading a digital thermometer and responses relating to this gained credit.)

Question 3

(a)(i) Most students gained this mark though some (uncredited) responses showed a complete lack of understanding.

(a)(ii) Most students gained both marks. The most frequent reason for gaining only one mark was failing to include the unit in the answer.

(a)(iii) Most students gained at least two of the three marks available. Some did not remember or use the information given earlier about half-life when responding to this question which made it more difficult for them to gain full marks.

(b) Most students gained 2 or 3 marks. The main reasons for not gaining full marks were not identifying that tracers emit gamma radiation and making no link to the 24 hour period stated in the question.

(c)(i) Most students gained 3 marks. It was disappointing to see that there are still students who assume that all best fit lines must be straight rather than fitting the shape made by the points plotted.

(c)(ii) About half of students gained both marks. The main reasons for failing to score included measuring half-life from 140 cpm to 80 cpm rather than 70 cpm.

(d)(i) Most students gained 1 mark. Inability to manipulate the equation, including failing to invert the 'answer' obtained, stopped many students from scoring the second mark.

(d)(ii) Most students gained this mark.

Question 4

(a)(i) This was generally answered well, with most students gaining at least 3 marks. Almost all students identified penetration tests as an appropriate method and described these with varying degrees of accuracy and detail. The students who suggested that beta radiation could be identified because it wouldn't penetrate through the experimenter's hand did not gain any marks for this question due to the extreme danger of doing this.

(a)(ii) Most students gained both marks. Those who suggested carrying out the experiment in a lead-lined room or somewhere where there was no background radiation did not gain the second mark as both suggestions are totally unrealistic.

(b) This was generally well answered. Incorrect responses tended to link half-life to type of radiation emitted, which is not correct.

Question 5

(a) Many students gained full marks. Generally, problems occurred because students could not manipulate the equation or, more worryingly, substituted the value of critical angle given for 'n' rather than 'c'.

(b)(i) Most students gained both marks

(b)(ii) Few students gained these marks, showing little understanding of what happens when the incident ray is equal to the critical angle.

(b)(iii) Most students gained one or two marks. Inaccuracy in drawing the reflected ray at the correct angle was the most common reason for students gaining one mark rather than two.

(c) Most students answered both parts of this question correctly.

(d) This was generally very well answered. Marks tended to be lost because students did not explain why a lower critical angle made it more likely for rays to reflect or because the response was poorly structured or written in poor English.

Question 6

(a) Most students gained both marks.

(b)(i) Most students gained both marks.

(b)(ii) Most students gained two or three marks. The most common reasons for not getting full marks were failure to include the correct unit in the answer and putting the numerator and denominator the wrong way round when doing the division, assuming it should be a large number divided by a smaller number.

(c) Most students gained both marks.

(d) Many students gained all four marks. Unfortunately, many others did not answer the question asked and actually said why ultrasound would have been a better choice. This meant that their responses often did not actually answer the question and limited the marks they could be awarded.

(e) Most students gained at least one mark but there were a substantial minority who did not seem to have come across the concept of organ affinity.

Mark Ranges and Award of Grades

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