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Examiners' Report
Principal Examiner Feedback

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Physics (4PH1) Paper 2PR

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Question 1

Most students knew that it was necessary to rub the plastic rod to charge it in Q1(a)(i). However, some students were not awarded the second mark due to giving an unsuitable insulator, such as skin or a wall. It was pleasing to see the majority of students describe a suitable demonstration for the charged rod in Q1(a)(iv) and score both marks. Those who did not gain both marks usually gave an incorrect or absent observation of what their chosen demonstration would do.

The majority of students gave a suitable use of electrostatic charges in Q1(b)(i). Some students were not awarded the mark due to their response being too vague e.g. “painting a bicycle” rather than “spray painting a bicycle”, the latter of which being considered acceptable. Many students needlessly explained how the plane became charged in Q1(b)(ii), showing that they did not understand the demand of the question. Common misconceptions were electric shock, interference with the plane’s electronics and fire caused by high temperature.

Question 2

Most students used and rearranged the formula correctly in Q2(a). Some left the answer as a fraction and some were unable to evaluate the reciprocal of the frequency given in standard form – these problems may have arisen from incorrectly using their calculator. Students who were familiar with the relevant formula often went on to score full marks in Q2(b). It was common to see a power of ten error in the student’s evaluation, which lost 1 mark.

Question 3

The majority of students knew that the centre of gravity of the stone block should be vertically in line with its weight, but most did not know that it is located at the origin of the weight force arrow. Some students did not read the question correctly and marked the centre of gravity with a dot (rather than a X), but this was still accepted. The linked calculations starting with Q3(a)(ii) were answered well. The statement of the principle of moments seldom referred to balance or equilibrium in Q3(b)(i), although a majority equated clockwise and anticlockwise moments. There was confusion for some students between moments and momentum. The calculation in Q3(b)(ii) using the principle of moments was generally well done, though it was clear that greater success was had by students that clearly wrote out each stage of their calculation. It was also easier to award intermediate marks if their final answer was incorrect. The most common error in Q3(b)(iii) was students adding 0.3m to their previous answer, rather than recognising the plank would be twice distance X.

Question 4

Many students scored two marks in Q4(a)(i), forgetting to include a measuring instrument in their description. In Q4(a)(ii), the idea of reaction time being problematic for such a short time interval was the most common way students scored a mark. Students should be reminded that vague answers such as “human error” are unlikely to gain credit unless they explain how the error arises.

In Q4(b)(i), more able students were able to suggest that it was important to have the same temperature at all points between the microphones, but a very common response gaining no credit was a reference to a fair test. The most common error in Q4(b)(ii) was quoting the average to an incorrect number of decimal places. Students would benefit from being shown how to use the figures already quoted in a table as a guide to the resolution needed for any additional figures. The other error seen was neglecting to add the value for sensor 1 when calculating the average, something that might be picked up if students are encouraged to go back and check their work. The majority of students were able to identify the anomolous result on the graph in Q4(b)(iii) and give a correct method of dealing with it in Q4(b)(iv).

Few students gained full marks in Q4(b)(v) as they did not describe both variables as being continuous – the crucial factor in deciding on the use of a line graph. Most students gained a mark in Q4(b)(vi) by a simple pattern statement. Many students had the misconception that any straight line graph always demonstrates proportionality; these students were unable to gain the second mark.

Question 5

"Show that" questions have been a feature of International GCSE examinations for several series now. It is essential when answering these for students to show all stages in their working, as they have already been told what the answer should approximately be. It was encouraging that a larger number of students were doing this to gain full marks. The step most often left out was the evaluation in joules, prior to the conversion to megajoules. Given that an approximate answer was given in the question, it was disappointing to see that some students completed a calculation that gave a wildly different answer, without any attempt to go back and check their working.

The calculation in Q5(b)(ii) was answered well by most students and it was encouraging to see that most showed all the steps in their working. This made it easier to award intermediate marks if they made an error in their calculation. The most common error was in working out the final temperature from a starting point of 20°C. A few students tried to convert to the kelvin scale, which was generally unsuccessful. Q5(b)(iii) required an answer in terms of energy and the most common answers that gained no credit were about heat being lost.

Question 6

Q6(a) was rarely answered with a focused approach and it illustrated the need for students to properly read the question and to answer the question being asked. Many students gave very accurate descriptions of the arrangement of particles in the three states but, as the question asked about movement, no marks could be awarded. The most common correct response was "vibrate" for solids, closely followed by "move freely" for gases. Few students could describe the motion of particles in a liquid satisfactorily, often just saying they are "free to move".

Most students in Q6(b)(i) answered using traditional nomenclature associated with energy, rather than the stores and transfers approach encouraged by this specification. Most students were able to score the first and final marks for chemical and thermal stores in the fuel and water respectively but struggled to communicate that this energy is transferred by heating to gain the second mark. Some students who were awarded the second mark correctly identified that a convection current was transferring the energy from the fuel to the water.

Although many students had the right idea about the meaning of the graph, relatively few were able to construct a response to score both marks. Specifically, they failed to explicitly identify the horizontal part of the line as the change of state. This may have been due to an inability to link the command word “explain” to the demands of the question.

Question 7

More able students gained full marks in Q7(a), often from a labelled diagram alone. Their most common error was to forget the need for a soft iron core. The weakest students answered in terms of a permanent magnet, gaining no credit. In Q7(b), very few students were able to apply the left-hand rule correctly to the context to determine the direction of the force on the proton.

Although Q7(c)(i) was a very common question, most students were unable to score both marks. Students recognized that half-life related to a time period but many were unable to satisfactorily explain that it related to the decay of the isotope. The most common errors were referring to the “halving of the mass”, “decay of an atom/nucleus” or “halving of reactivity”. Q7(c)(ii) proved difficult with several students seeming to think that the barium atoms were stopped by the wall instead of the radiation produced by them. More able students gave answers in terms of the number of half-lives as well as the inability of the radiation to pass through the concrete walls.

Question 8

Most students were able to state that the Universe started as a single point and then expanded in Q8(a). The idea that the Universe has cooled since the Big Bang rarely appeared in their answers. There were many excellent responses in Q8(b) with the most able students scoring MP1, MP2, MP3 and MP4. Weaker responses often missed out galaxies when referring to red-shift and those who included galaxies often stated that they were moving away from us rather than each other.

Paper Summary

Based on their performance in this examination, students are offered the following advice:

- Attempt all questions in the examination, even if they are unsure of the quality or accuracy of their response.
- Take note of the number of marks given for each question and use this as a guide as to the amount of detail expected in the answer.
- Take note of the command word used in each question to determine how the examiner expects the question to be answered, for instance whether to give a description or an explanation.
- Be familiar with the formulae listed in the specification and be able to use them confidently.
- Know the SI units for physical quantities and be able to convert from non-SI units to SI units when required.
- Show all working so that some credit can still be given for answers that are only partly correct.
- Take advantage of opportunities to draw labelled diagrams as well as, or instead of, written answers.
- Be ready to comment on data and suggest improvements to experimental methods.

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