Examiners' Report
Principal Examiner Feedback

November 2020

Pearson Edexcel International GCSE
In Physics (4SD0) Paper 1P

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Question 1
Students generally performed well in these straightforward questions. A minority confused the diagrams for total internal reflection and reflection and were only awarded 2 marks in Q1(a). A significant number of students misread Q1(b) and gave properties shared by all electromagnetic waves, rather than all waves.

Question 2
This question was well-answered by many students who demonstrated a high level of understanding of velocity-time graphs. The majority of students correctly attempted to find the gradient of the line in Q2(a) or used the formula for acceleration. Students tended to lose marks only when they misread data from the line. Students who knew that the distance was equal to the area under the line generally scored full marks in Q2(b), but a significant number of students incorrectly used the formula
distance = speed × time. It was interesting to see some students attempt to use $v^2 = u^2 + 2as$ in this question, which was awarded full marks when done correctly. Q2(c) was the best answered part of this question; the majority of students knew that the line would be less steep than the original.

Question 3
There were some extremely good responses from able students in Q3(a). They were able to give the complete sequence in the correct order, with the protostar stage being the main omission. Some students gained full marks with the shortest response while the majority went in to a lengthy explanation of the evolution of the main sequence stage. It was unfortunate that some students limited their response to 2 marks due to the inclusion of irrelevant evolutionary stages such as supernova, neutron star, black holes etc. A minority of students appeared not to have learned this part of the specification and gave largely irrelevant responses. In Q3(b) a noticeable number of students wrote about stars releasing much more energy than fission reactors or that energy release was uncontrolled in stars but regulated in fission reactors by the use of control rods. These suggestions were not credited. Those students who only scored 2 marks often wrote accurately that fusion occurs in stars and fission occurs in reactors as well as describing either fusion or fission but not both.

Question 4
Hooke’s Law was generally well-known in Q4(a)(i) but few students gained the second mark by stating that it only applies up to a particular limit. The majority of students also performed well in Q4(a)(ii) and recognised that the curved line showed behaviour that does not follow Hooke’s Law. Students were able to complete the energy related sentences in 4(b) to a high standard. The most common mistake was choosing an incorrect word for the first sentence. A significant number of students referred to the downwards force acting on the object in Q4(b) as “gravity” and were not awarded the mark. Many also did not gain the full 4 marks available as they did not ensure that the force arrows they drew

were the same length as the lift and thrust arrows, showing a lack of understanding of the conditions needed for motion at a constant speed.

Question 5
Many students struggled with Q5(a) due to not knowing the correct circuit symbols for the given components. This was especially true for the variable resistor. A number of other students also lost marks by drawing all the components on the same series loop, rather than the voltmeter being connected in parallel with component X. However, the majority of students drew fully correct circuit diagrams for this common experiment. The graph work in Q5(b) differentiated well between students working within different ability ranges. There were some excellent, carefully drawn graphs produced by a large number of students. At the other end of the ability range mistakes included failing to label the graph's axes, constructing non-linear scales and not drawing smooth curves of best fit – this was especially the case when linking the final two points together.

Question 6
The open-ended calculation in Q6(a) was well-answered by many students and their work clearly showed how the resistance of the resistor approximated to 400Ω. Weaker students knew to use Ohm's Law and often rearranged this correctly with a valid data substitution to gain 2 marks, but struggled to make further progress due to not converting milliamps to amps. Q6(b) was poorly answered by all but the most able students. Most students gave vague statements about resistance changing with temperature, but did not link these to the thermistor. However, it was encouraging to see a significant number of students give convincing potential divider arguments in their answer, showing a thorough understanding of how voltages are related in a series circuit.

Question 7
It was very pleasing to see most students attempt to use the correct formula, $v^2 = u^2 + 2as$, to answer the calculation in Q7(a). Students were able to gain some credit for a valid substitution, but some lost marks for not converting the distance from kilometres to metres or encountering problems when rearranging the formula.

There were lots of good answers to Q7(b)(i). An understanding of particles colliding with the walls was sometimes not translated into the resulting force on the wall or that force over a given area creates the pressure. The most common mistake was when students described particles colliding with each other, rather than the walls of the container. The following calculation in Q7(b)(ii) was answered to a very high standard with the majority of students scoring full marks. Some students incorrectly attempted to use the formula linking the pressure and volume of a gas, whilst others incorrectly attempted to convert the temperatures from kelvin to celsius.

The scenario described in Q7(b)(iii) was well-known and it was pleasing to see students make good progress in their responses. Students sometimes omitted explaining that collisions were more frequent with the container *walls* and that more force was being exerted on the *walls*. A typical statement was "the particles collide more often and with more force". The final explanation in this question was challenging and most students failed to score due to linking a higher pressure with a higher accelerating force being exerted on the particles as they left the chamber. Those students who made progress usually discussed the higher initial speed or kinetic energy possessed by the Tvashtar particles. Only the best students could link this idea succcessfully to the greater height attained by these particles.

Question 8

The majority of students stated the formula correctly in Q8(a)(i). Some forgot the sine function, even though they sometimes used the correct version in Q8(a)(ii). Those students who knew the formula usually made good progress in the calculation itself. Rearrangement and manipulation of the sine function caused a few problems in addition to not expressing the final answer to 5 significant figures as requested.

Students found Q8(b)(i) challenging and many drew the refracted ray the wrong side of the normal line. Only the most able students drew the refracted ray the correct side of the normal and bending in the correct direction to score both marks. Most students went on to score the first mark in Q8(b)(ii), usually for recognising that the incident ray was perpendicular to the boundary or passing along the normal.

Q8(b)(iii) was a good discriminator by ability. Those students who did not score often wrote that the wavelength reduces as light moves from an optically less dense medium to an optically more dense medium but did not go on to explain why. Those who scored both marks most often wrote that the wave speed decreases and $v = f \times \lambda$. A noticeable number wrote that the ozone layer is responsible for the reduction in wavelength. Q8(b)(iv) proved to be too challenging for all but the most able students. Lots of students wrote that the Sun's light was refracted, but did not expand on this further so scored no marks. A large number also wrote that the Sun was setting and therefore part of it was below the horizon hence it did not appear to be circular. There were a large number of blank responses to this question.

Question 9

Q9(a) was generally well-understood but a lot of students did not score the first mark due to suggesting that the rotation of the coil was due to the motor effect, rather than the turning of the handle. Almost all students knew the correct formula to use in Q9(b) and went on to make good progress in the subsequent calculation. Where marks were lost, these were usually for incorrectly rearranging the formula or not converting megahertz to hertz correctly.

Despite the loudspeaker being specifically mentioned in the specification, many students' responses suggested that they had very little understanding of how one worked. Students who recognised Q9(c)(i) as a fairly standard question usually scored heavily. The majority of students were able to suggest a suitable modification in Q9(c)(ii) that would increase the force on the loudspeaker coil.

Question 10

Some students offered a generic isotopes-based answer to Q10(a)(i) rather than tailoring their answer to the question. These students only scored the first marking point. A significant number of students did not correctly balance the nulclear equation in Q10(a)(ii) despite recalling that the atomic number of the beta particle is -1. Students mainly scored well in Q10(b). Almost all were familiar with the GM tube. Many also understood the importance of accounting for background radiation and the inherent need in this experiment to take repeats and find the mean. There was some confusion when describing how to interpret the results from using paper, aluminium and lead as absorbers. Most students gave a good safety precaution although some were a little too vague. In Q10(c) many students ignored the instructions and did not use any of the data from the graph, therefore scoring no marks. They often stated that the relationship was not a constant as the graph was inversely proportional. Students must ensure that they read the stem of the question thoroughly.

Question 11

Most students could give a valid similarity and difference for the orbits described in Q11(a)(i) and and Q11(a)(ii). The calculation in Q11(b)(i) was very pleasing to mark and most students scored at least 1 mark for a valid substitution or correctly converting hours to seconds. The majority of students could successfully calculate the orbital radius of the satellite, but only the most able knew to subtract the radius of the Earth to obtain the height of the orbit.

There appeared to be good understanding of the Doppler effect from many students in Q11(b)(ii), but some lost marks due to vague commmunication. Too many referred to the source being either close or far away without a sense of motion between the source and the observer. Few students referred to the speed of waves being constant. In Q11(b)(iii) a number of students referred to space being a vacuum or not having any atmosphere or that the distance between the satellite and Earth was small and stated that this is a reason the radio waves are not affected by the Doppler effect. Some also suggested that radio waves are not affected as they are either transverse / longitudinal or part of the EM spectrum.

Paper Summary

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

- Attempt all questions even if the student is unsure 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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