# Examiners' Report
# Principal Examiner Feedback

## November 2023

Pearson Edexcel International GCSE
In Physics (4PH1) Paper 1P and
Science Double Award (4SD0) Paper 1P

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**Question 1**
Most candidates were able to select the correct responses in the multiple choice questions Q1(a), Q1(b) and Q1(c). Of these, Q1(b) proved to be the most challenging, with some candidates confusing the newton as the unit for gravitational field strength, rather than the newton per kilogram. The majority of candidates were able to score at least one mark in Q1(d), usually for the difference in the shape of the orbits. Some candidates tought that both moons and comets orbit planets, whilst others did not take full advantage of the opportunity to include clearly labelled diagrams in their response.

**Question 2**
The majority of candidates scored at least 2 marks in this question, with most scoring full marks. There was no discernible pattern in the mistakes made, but the weakest candidates misinterpreted the question and placed ticks in the boxes, rather than a letter corresponding to a particular graph.

**Question 3**
Q3(a) was generally answered to a high standard. Most candidates were able to achieve at least 1 mark for giving a response within the range of 12cm – 13cm in Q3(a)(i), although it was clear that many had no experience of determining wavelength from a graphical representation, something that could usefully be addressed. Very few did not fulfil the "show that" requirement of Q3(a)(ii), which requires all working to be written down, which was pleasing. The error carried forward (ecf) from Q3(a)(i) into Q3(a)(ii) ensured that the substitution mark was achieved by most candidates but many then multiplied by 2.35 by $10^7$ and left the wavelength in cm. This gave an answer that rounded to $3\times10^8$, but it did not show the required conversion of GHz to Hz (multiply by $10^9$). Candidates will benefit from reviewing the conversion conventions and the requirements of a number set in standard form.

Candidates found Q3(b) more challenging and most did not score the mark despite this being direct recall from the specification. Candidates often did not make reference to the heating effect being experienced by internal tissues or organs. Weaker candidates referred to burns or cancer, which were not credited.

**Question 4**
Most candidates chose the correct symbol for the filament lamp in Q4(a) and it was encouraging to see the majority of candidates score full marks in Q4(b). However, some candidates were limited to 1 mark due to ticking more than two of the statements. In Q4(c), candidates who maintained the principle of the normal being at 90 degrees to the point of contact of the incident ray with the mirror were then able to successfully complete the normal and then the reflected ray and the angle of reflection. Many candidates drew the normal horizontally, perhaps copying the normals they had drawn on paper when carrying out similar experiments in their practical lessons. However, they often went on to gain both marks in Q4(c)(ii). A surprisingly large number of candidates drew refracted rays instead of, or in addition to, a reflected ray.

The calculation in Q4(d)(i) was generally answered well and most candidates scored at least 2 marks. The most common response gave an answer of 0.44A as those candidates had failed to appreciate that there were 3 cells. In Q4(d)(ii), some candidates linked the observation to the wire being magnetic, without referencing the current creating a magnetic field. Others indicated that the flow of current directly caused the needle to move; sometimes this was thought to be because the needle was a conductor, and current would flow through it.

**Question 5**

Candidates generally displayed a high level of understanding in Q5(a). Candidates were able to relate the insulating properties of wood to the set up and context of the question. MP1 and MP2 were frequently awarded. Common errors involved referring to the wood as a bad conductor of electricity and a risk of electric shock, wood absorbing heat, wood acting as an insulator preventing heat loss from the metal strips or that the wood holds the metal strips in place.

Q5(b) proved to be much more challenging. There appeared to be a widespread misconception that particles in a solid are not vibrating until they are heated and as a consequence many did not write about the vibrations increasing in speed or amplitude. Instead, candidates wrote that heating *caused* the particles to vibrate. Teachers should emphasise that, unless at absolute zero, particles vibrate and as they gain KE those vibrations increase in amplitude and the speed at which they vibrate. Very few candidates could be awarded the last marking point as they talked of the energy being passed along, which they were told in the stem of the question, rather than the vibrations. Those who were able to relate increased speed of moving delocalised electrons were also able to gain credit although, again, few successfully described the end result of increased speed causing increased collisions further along the metal.

Only a third of all candidates could give a suitable justification of the use of a bar chart in Q5(c)(i). Most irrelevant responses focused on the use of a bar chart due to its ability to give a clear comparison of values. However, candidates performed much better in Q5(c)(ii) and most scored at least one mark for a suggestion of repeating the experiment. More able candidates then scored a further mark for suggesting a reason for taking repeats. Q5(c)(iii) differentiated well. A significant number of candidates correctly recognised that the time taken was longer for iron but stated that this was due to it conducting heat faster. Candidates who were able to relate conductivity to the time for the tack to fall were able to gain full credit.

**Question 6**

Q6(a) was answered extremely well in parts (i) and (ii) with high levels of correct responses. Those who used the area of a triangle and not speed = distance ÷ time went onto achieve the marks in part (iii). Many candidates mentioned the gradient of the line or line between velocity and time as the feature giving the distance in part (ii). Q6(b) was answered well by candidates that used data from the table as instructed in the question, with MP1 and MP2 being frequently achieved. However, some candidates then missed out on MP3 by not clearly giving a comparison between the two values to confirm

that they were constant. Some candidates did not answer the question asked and, instead of using data from the table, tried to use one or more pairs from the graph which could not be credited.

**Question 7**

Half of all candidates successfully identified particle X as a proton in Q7(a)(i). Some candidates were able to correctly identify both changes that occurred to the number of protons and neutrons and state these in their answers in Q7(a)(ii). A greater proportion of candidates earned one mark for correctly identifying the change to only one of the particles. However, many candidates did not score any marks, despite stating that a neutron changes into a proton as this did not sufficiently answer the question.

The quality of graph drawing skills was high in Q7(b) and most candidates scored full marks. Marks were most frequently lost for poorly drawn curves or not labelling axes appropriately. Weaker candidates experienced difficulties constructing appropriate scales or made plotting errors.

Candidates who had a full understanding of the concept of radioactive contamination were able to successfully fulfil the requirements of the mark scheme for Q7(c)(i) and Q7(c)(ii) in relation to more carbon-14 within samples. Less frequently, candidates identified that this translated to a sample age that is much younger. There were relatively high volumes of zero response for both questions. Many candidates incorrectly wrote that trees would die as a result of the increased concentration of carbon-14 in the atmosphere. Many also wrote about the half-life of carbon-14 being longer or shorter due to the increased concentration in the atmosphere. Candidates would benefit from exploring carbon dating in more depth, especially its applications.

**Question 8**

Most candidates correctly labelled the diagram with an arrow from the star to the centre of the galaxy in Q8(a). Most incorrect answers were either an arrow that was flipped 180 degrees from correct (centre of galaxy to star) or their arrows were around the direction of the star's orbit around the galactic centre. Most candidates were also able to demonstrate the derivation of the light year conversion to metres requested in Q8(b)(i). Occasionally, the lack of evaluating their calculation to two decimal places or more resulted in the final mark being withheld. Most candidates performed well in Q8(b)(ii) and achieved credit of 2 marks as a power of ten (POT) for those that used the correct formula and not speed, distance, and time. The most common errors were to omit the use of $2\pi$ or a POT error due to incorrect conversion to metres. Some candidates misunderstood the 29000 light years measurement to be a diameter so divided it by two to get an orbital radius.

**Question 9**

Surprisingly, only half of all candidates could give the name of a valid fuel in a nuclear reactor in Q9(a)(i). Many candidates' incorrect answers were usually other types of fuel. Coal, kerosene and gas were the most commonly seen incorrect answers. In Q9(a)(ii), credit was gained by most candidates with MP2 and MP3 attributing to this outcome. Candidates who focused on the uranium-235 nucleus (not atom) when undergoing fission were more likely to gain credit. The biggest issue was candidates not realising that when

talking of fission, or indeed fusion, processes it is always the nucleus that is involved. Others confused nucleus and neutron. There was a noticeable number of candidates writing about how power stations generate electricity instead of the process of nuclear fission.

There was a lot of confusion in Q9(b)(i) between a motor and a generator with many candidates referring to current passing through the wire, which causes the wire to interact with the field. There were some, but not many, clear and concise 3 mark responses. Many referred to a magnetic field being cut but failed to mention that this magnetic field was due to the magnets. In Q9(b)(ii), half of all candidates were able to give a sensible way of reducing the output of the generator. Incorrect answers focused on the use of transformers or simply stated to reduce the current, which were not credited. In Q9(b)(iii), most candidates were able to achieve at least one mark for the idea that d.c. flows in one direction. The second mark for the a.c. changing direction continuously was harder to achieve.

**Question 10**

Candidates performed very well in Q10(a). Most were able to score at least 2 marks for the actual calculation, with the only common error due to not converting the resistance value from kΩ to Ω. Only half of all candidates were able to select the correct circuit symbol and correctly place it in the circuit in Q10(b)(i). Some candidates used a symbol with an "M" in a circle. Incorrect answers where the correct symbol was chosen were mostly placed on one of the vertical branches of the main circuit. Some were seen placed in parallel around the 13 kΩ resistor. Q10(b)(ii) proved to be one of the most challenging questions in the paper and many misconceptions of parallel circuits were exhibited. Some candidates lost all the marks by thinking that closing a switch meant turning everything off. In the first part, the added resistor was thought to increase the resistance. More marks were gained later, with marks being garnered across all three points. Full marks could be gained by explicit calculations in both parts.

**Question 11**

Most candidates gained full credit in Q11(a) or three marks for a POT error by missing the conversion of the units. The most common errors were failing to convert kPa to Pa, use of an incorrect pressure difference e.g. 117kPa or 129 kPa, incorrect rearrangements of the formula or missing the value of $g$. Teachers should advise candidates to write the formula down, insert the values, then rearrange so that they can access at least the marks for substitution.

Candidates who were able to relate particle theory to the particles of air/gas within the barometer and their interaction with the walls of the barometer went on to gain full credit in Q11(b)(i). The most common answers that did not score did not write about particles; instead they wrote that temperature and pressure are directly proportional. Other mistakes included writing that particles collide with each other more often, neglecting collisions between particles and the container walls, or failing to write that particles collide with the walls more often / with increased frequency. Q11(b)(ii) was generally answered to a high standard. Most candidates achieved full credit or 3 marks for not converting the units of temperature.

**Question 12**

Q12(a) was generally answered well. MP3 and MP4 were frequently awarded. Candidates who were able to relate to energy transfers within the closed system went on to successfully identify transfers and their associated transfer mechanisms. Some described forces or momentum or acceleration; these candidates may not have read the question properly. Some thought that the marble gains gravitational potential energy as it falls. Very few mentioned mechanical transfer and although many were aware that there was some transfer of thermal energy, not many specifically referred to either the marble, run or the surroundings. MP8 was mostly awarded for 'lost as sound' rather than transferred by radiation.

In Q12(b)(i), candidates who were able to identify that the measurements take place at the point of the marble leaving point B went on to gain full credit for this question. In most cases MP3 was successfully given. Measuring the distance and time taken from A to B was the most common response with candidates failing to read the question carefully. Very few candidates wrote about using light gates attached to a datalogger as a method and would benefit from being exposed to this procedure in greater depth. Many candidates were able to gain credit for the correct use of the GPE and KE formulae in Q12(b)(ii). Those that were able to correctly use SI units and work out the energy loss by subtraction went on to achieve full credit. Teachers need to emphasise to candidates that masses need to always be converted to kg when completing calculations as many lost 1 mark for not doing so. Having been given all the necessary formulae, a small number tried to use $v^2 = u^2 + 2as$ unsuccessfully. Some also did not access the final mark as instead of subtracting the value for KE from GPE they added them together instead.

**Paper Summary**

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

- Attempt all questions even if the candidate 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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