Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International GCSE
in Physics (4WSD6) Unit 6P

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General Comments

As in the previous examination series, most candidates were able to make good use the additional formula sheet or recall the equations from memory, and many handled the associated calculations competently.

Practical questions were best answered by candidates who appeared to be writing from first-hand experience, with clear, structured responses that followed the expected procedure. This was particularly evident in questions involving the use of oscilloscopes, the investigation of radiation penetration, and the plotting of graphs.

Responses to longer questions varied wildly in quality. Stronger candidates were able to develop clear and accurate explanations, while less able candidates found it difficult to assemble a coherent response, or to present a logical argument when required, for example when discussing nuclear reactors or magnetic fields.

Misconceptions were seen across several topics including stellar evolution, the interpretation of magnetic field diagrams, and the components of a nuclear reactor. Graph drawing skills also proved variable with many candidates using inappropriately inappropriate scales, overly large plotting symbols, or failing to extrapolate correctly.

Compared to previous papers in the linear series, a higher proportion of candidates appeared not to be fully prepared for some aspects of the exam, particularly those involving data analysis, all the application physics in unfamiliar contexts. Nevertheless, it was encouraging to see many candidates who were able to give full and accurate answers, supported by clear reasoning and the correct use of scientific language.

Comments on Individual Questions

Q1(a)(i) - Candidates who chose to write the formula in words occasionally lost the sine function from their equations, losing the mark – which should have been simple as they could be copied from the formula sheet.

Q1(a)(ii) - Good candidates found this straightforward and score full marks. Weaker candidates often failed to take the sine of 18 degrees and simply substituted 18 into the equation, and some candidates also used r = sin (18) / sin (1.52). Both give answers that round to 12 but were not creditworthy as the physics is incorrect. It is important that candidates give clear working to show where their values have come from.

Q1(b)(i) – Generally completed well for both marks. A few students mistook 'refraction' for 'reflection'.

Q1(b)(ii) – Most learners were able to substitute into the equation and calculate it correctly. The most common error seen was substitution of the incorrect number from elsewhere in the question.

Q1(b)(iii) - Many suggested multiple valid uses. The most common answer was optical fibres, with periscopes, binoculars and endoscopes also being commonly given. Some answers were too vague, such as 'communications' or 'medical uses'. Some candidates attempted to describe what would happen to the light or what the effect would be like here, rather than suggesting a use for it.

Example

(1)

Optical fiber cabels for the internet

This item scores 1 mark – the mark was scored once "optical fibre" was seen.

Q2(a) and Q2(b) – Most candidates were able to achieve this mark successfully.

Q2(c) – Most candidates knew that they needed to calculate the reciprocal of the frequency, however some were unable to evaluate the final answer. Further practice in using a calculator to find a reciprocal would be beneficial for candidates.

Q2(d) - Strong candidates gave clear definitions of the two waves addressing the three areas of what was happening, in what direction, and a frame of reference. Where full marks were not achieved, candidates commonly stated that transverse waves are perpendicular while longitudinal waves are parallel, but they had difficulty saying what is perpendicular or parallel to what – vibrations were often missing, or the direction of energy transfer was missing, or both.

Many drew diagrams, which, if labelled, gained some credit. Some answers gave other differences such as need for medium / ability to travel in vacuum or having compressions and rarefactions (sometimes 'refractions') or having peaks or crests and troughs. Some answers contained multiple correct contrasts.

Weaker candidates gave incorrect/vague descriptions of the two waves often only addressing one or two of the areas required.

Key terms such as vibrate or oscillate should be learned.

Q3(a) – Most answers that were seen were correct.

Q3(b) - Many answers correctly stated both the difference in shape and the difference in bodies orbited. Many candidates used the word oval rather than elliptical, and many unusual spellings were seen. This highlights the importance of using correct scientific terminology and spelling it accurately.

Q3(c) - The most common difficulty was with rounding – there were many instances of 7.6, 7.67 etc. Candidates should be reminded to use the exact value of pi, rather than approximations like 3.1 or 22/7, and should select a calculator that is able to do this. The most common mistake seen was to omit 2π from the equation.

Q4(a) – Overall, this question was very poorly answered – it seemed that many candidates had not seen this demonstration (the specification point explicitly states: 'practical: investigate the penetration powers of different types of radiation using either radioactive sources or simulation'). The strongest answers contained a relevant diagram and clear points about what needs to be done.

Many high achieving responses included every point in the mark scheme, and many that scored 5 could have scored more. Diagrams usually made it much easier to award some of the available marks, although some diagrams seemed rather to be a pictorial version of the list of equipment given in the question. It is strongly recommended to label / annotate diagrams given to add clarity.

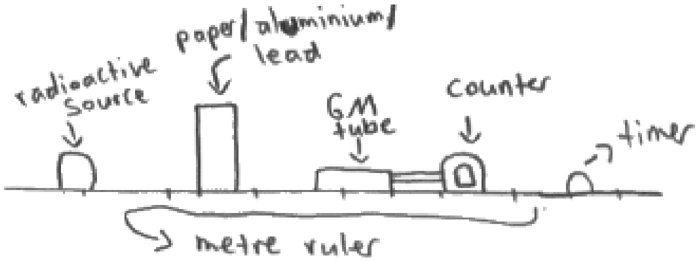
Weaker candidates often made vague statements and did not link what they would do with a relevant experimental step/procedure e.g. measure the distance between the source and GM tube with no reference to keeping it constant.

Many candidates who did not manage to score any other marks mentioned measuring background radiation and subtracting it. Some candidates showed physics knowledge, which was not creditable here, about different types of ionizing radiation.

Many candidates described what the results would be in general terms (alpha radiation will be stopped by paper…) after giving a very minimal description of the procedure, in fact some fairly long responses didn't have any procedural instructions at all and only contained information related to the topic, while others contained procedural instructions which would not give results, like 'use the metre ruler to measure the radiation' or 'use the timer to see how long it takes for the radiation to penetrate each material'. Likewise, 'use the ruler to measure how far each type of radiation penetrates' was very popular, but not creditworthy. Another common use of the ruler was to measure the thickness of the paper, aluminium and lead, and sometimes this was supposed to be kept the same. Some instructions would be very difficult to follow, such as 'place the gamma source several km away from the detector'. Most often, the instructions were short on details, such as where pieces of equipment ought to be in relation to each other. Many responses mentioned safety precautions such as handling the source with tongs and having the candidates keep some distance away from the demonstration. This reflects perhaps both the general emphasis placed on safety in the lab context; however, some candidates seemed to overestimate the feasibility to control radioactive sources.

Example

(5)



On the metre ruler, place radioactive material on one end. GM tube connected to a counter and a timer on the other end. First, without radioactive source, calculate background radiation. GM tube working for 5 minutes 3 times and average of results on counter taken in same time period. Then, alpha radiation source placed in front of GM tube. Calculate radiation for 5 minutes. ~~Place paper in front of it~~. Substract background radiation from the value. Put paper in front of it, measure radiation until it falls to background radiation. Alpha can't penetrate through paper. Repeat the experiment for the same time periods using beta radiation source and aluminium foil. Then gamma radiation with lead. Compare the results. You can use different radiation sources with all three materials to see the difference.

This response scored all 5 available marks: there are multiple ways of scoring full marks in this question – this example scores all the available marking points.

Q4(b) – This question required candidates to analyse the data given in the table. Many demonstrated that they knew of a connection between alpha radiation and paper, beta radiation and aluminium and gamma radiation and lead, however very few were able to apply this knowledge to the data given. More successful candidates often made errors in part (iii): the key physics here is that the gamma radiation passed through the aluminium, not that it was stopped by lead (this would not uniquely identify gamma radiation).

Other candidates had clear misconceptions in the penetration of the materials, incorrectly thinking that alpha radiation can penetrate paper, beta radiation can penetrate aluminium, and gamma radiation can penetrate lead. Some also wrote about other properties of alpha, beta and gamma radiation, such as what they consist of or their ionizing power.

Q5(a) - Many answers were very detailed and contained enough information to also answer 7(b). Diagrams were sometimes used to good effect, although they were occasionally unlabelled or otherwise unsuccessful.

Some answers did not mention neutrons but only nuclei splitting, sometimes into ever smaller nuclei. A few candidates seemed to confuse a chain reaction with reversible chemical reactions (such as the Haber process) as they mentioned equilibrium - one response offered the idea that fission and fusion are reversible, with one requiring energy and the other releasing it.

Q5(b) - There were some good diagrams which clearly showed both points. Candidates who used numbers (giving a number of neutrons or demonstrating the exponential increase) were also likely to score both marks.

Many responses demonstrated a partially correct approach but lacked sufficient clarity or detail to be awarded credit. Some other errors seen related to the use of control rods in a nuclear reactor, or other methods of controlling the reaction. Some wrote about nuclei and not about neutrons. It was quite common for responses to describe increasing heat increasing the rate of reaction, as in a chemical reaction.

Q5(c) - There were many labelled parts in the diagram and many candidates attempted to explain what all of them are made from and what they do, rather than focusing on the theme of the question. Many of these descriptions were accurate and detailed. But as only the moderator and the control rods were of interest, there was often not enough detail about them. Many misconceptions were seen relating to the role of the moderator, with only the most able candidates able to identify that it caused the rate of the reaction to increase.

Some answers gave or only gave a description of the process of fission, scoring no marks.

Example:

• Fuel rods have radioactive material which goes through nuclear fission releasing neutrons.
• Moderator slows down neutrons so they are more likely to cause further fission in other nuclei.
• Control rods absorb excess neutrons which can be changed. The reactor keeps the number of fissions stable with these.
• Coolant removes the heat produced by fission using a fluid that flows in and out.
These parts work together to ensure a controlled chain reaction.

This response scored 3 marks: two for the role of the moderator, and a further mark for the role of the control rods. Further detail would be needed to score higher marks.

5(d) - Candidates were most likely to score for stating that fusion requires high temperature and pressure. Some went on to explain that this was needed to overcome repulsion between nuclei (some even elaborated further). Some mentioned the large amount of power required. A few candidates may have thought that high temperatures and high pressures would be separate marking points, and many did not attempt an explanation which the command 'suggest why' requires.

6(a) - In what was expected to be straightforward question, candidates often gave too much further detail and thus contradicted themselves or put a correct statement in an incorrect context and could not gain credit.

Some candidates elaborated, 'the direction of the field from north to south' and 'when lines are closer together the field is stronger'. Some described the appearance of the lines (often not very accurately) rather than what they represent, for example 'lines are parallel, straight and evenly spaced', or 'lines never cross'.

Others described magnetic effects like 'shows if the magnet is attracting or repelling'. Some responses suggested that field lines represent the 'area where…' the magnet has some influence – the range or extent or size of the field.

6(b)(i) – The main misconception seen here was candidates confusing "charges" and "poles" of the magnet.

6(b)(ii) - Rather than 'induced magnet', most candidates used the wording 'it is magnetised' or 'iron is a soft magnetic material so it is easily magnetised and demagnetised' or 'it will be temporarily magnetised'. A common problem was the use of non-technical descriptions, such as 'it will stick to the magnet' 'it will get attached to the magnet'.

6(c) – Most candidates understood that a current needed to be added to the copper wire for it to be able to produce a magnetic field.

7(a) - Most candidates were able to achieve this mark successfully.

7(b)(i)-(iii) - It seems that candidates have not seen this demonstration and/or had the opportunity to use data to plot a graph and extrapolate to determine absolute zero.

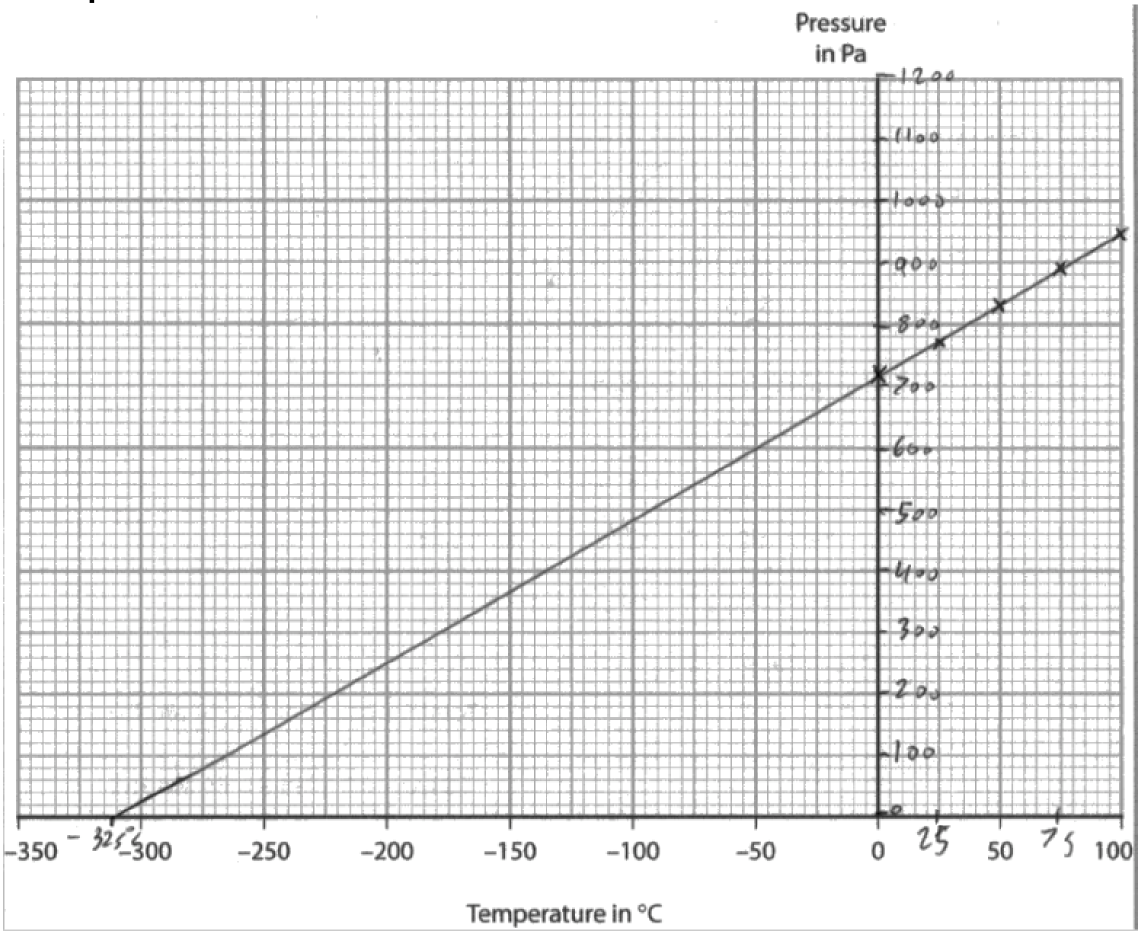
Many candidates chose a scale with a false origin to spread the points out, despite the clear instructions in the stem of the question. Some chose challenging scales to have a true origin and spread out the points as much as possible, such as 160, 165 or 175 to a large square, or 250 to 15 small squares. Although many of these unconventional scales still achieved successful plotting, these "awkward" scales are not acceptable.

Some candidates marked the points with blobs, and these were often too big to judge where the point was intended to be to the required precision. Some blobs were obviously the result of attempts to correct a mistake, while others were consistent, many as big as a whole square – candidates should be encouraged to use a small cross to identify each point.

Most candidates recognised that a straight line of best fit was appropriate here and most of these were correct. Weaker candidates often drew freehand between the plots or a 'dot to dot' line.

Only the strongest candidates scored here; weaker candidates were either unaware of the need to extrapolate and/or forced a line through -273. This value was also sometimes found on the answer line with no working to support it – likely through recall of the true value, rather than treating the results as an experimental outcome.

Example



This response scored all 5 marks available across the 3 question parts, and shows good plotting and extrapolation.

7(b)(iv) - This question required candidates to comment on experimental practice and was weakly answered by most candidates. Candidates were most likely to score for pointing out that the results are extrapolated, there is no measurement close to absolute zero, it is not possible to experiment at absolute zero. Some successful candidates also criticised the small range of the results.
Most common non creditworthy responses related to the experimental design, human error or demonstrated a misunderstanding about the nature of absolute zero.

7(c) - Strong candidates scored well here - recognising that at absolute zero values for speed/velocity and KE have a definitive value (of zero). Weaker candidates recognised that as you cool matter the speed/KE decreases but failed to link the condition (of being at absolute zero) to there being no motion etc. The motion of particles in a solid state was often described, for example packed together and vibrating in formation.

Example

At absolute zero the particles would not move at all since there is no kinetic energy to be given or transferred. The absolute zero would keep particles completely frozen.

This response scores both marks for a clear explanation covering both marking points.

Summary

Based on their performance on this paper, candidates should:

- Practice writing detailed descriptions of practical experiments and focus on applying their knowledge to the context given in the question.
- Develop greater precision in scientific terminology and explanations, especially when describing wave behaviour, magnetic fields, and radioactive decay.
- Improve data-handling skills, particularly when plotting graphs, selecting appropriate scales, and interpreting experimental results rather than relying on recall.
- Show full and clear working in calculations, avoiding premature rounding and using correct formulae, units, and significant figures throughout.
- Learn to interpret what is being asked by the command word (e.g. suggest why, explain, calculate) and tailor their responses accordingly, especially when justifying experimental conclusions.

Please refer and link to the International GCSE Physics (Modular) Specification and/or Sample Assessment Materials (SAMs) on the Pearson Edexcel website.

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