Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International GCSE
in Physics (4WPH2) Unit 2P

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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) – The majority of candidates were successful in this question: almost all students were able to identify that the evolution originates from a nebula. Some students confused the position of a neutron star, putting it before a supernova, rather than after. Candidates must be able to recall the correct sequence of stellar evolution.

Q1(b) – Most candidates answered this question correctly – “M” was most accurately plotted, with “R” and “W” also often being plotted successfully. The most common errors were to plot them too high on the absolute magnitude axis.

Q1(c) – Candidates generally performed well on this question, the main misconception being candidates stating “mass”.

Q2(a) – Candidates generally performed well, with most candidates scoring both marks.

Q2(b)(i) – Candidates generally scored this mark – there were a range of unusual responses, such as “GM tube”. It is recommended that learners have hands-on experience with this apparatus, or using a simulation, to familiarise themselves with the equipment necessary.

Q2(b)(ii) – Very few responses scored MP2, with a significant number of candidates mentioned counting the divisions for one wave.

A significant number of candidates either described an experiment to determine the speed of sound (for example by timing an echo from a wall some known distance away) - this was in the specimen assessment materials - or made general comments relating frequency to time period and/or the wave equation, which did not give the practical details required on use of the oscilloscope.

Examples

two students stand besideeachother, ~~th~~ oneofThe have apistol andTheother haveatimmer. ~~w~~ The first student fires The pistol, whentheotherstudent see smoke he start timingand whenhe hears asound hestopstiming the distance ~~mo~~ havetobelarge to reduceThe reactiontime andgetmoreaccurate tempratures. ~~Then~~ AsThe student must have measuredThe distunceby measuring tabe and measured the timebyusingstopwatch. ~~Then you can get the time by~~

This response scored 0 marks, as it is related to the wrong practical: candidates should be reminded to answer the question set, not the one they would *like* to be set.

connect a microphone to the oscilloscope. then adjust the oscilloscope to give one complete steady wave. ~~cou~~ ~~mea~~ calculate the Time period by counting the number of squares for one complete wave and multiplying it by the timebase. Repeat each reading 3 times and calculate an average

This response scored two marks, for producing one wave on the screen, and for the counting process. It did not score the third mark as only one wave was considered.

Q2(b)(iii) - The amplitude was more often correct than the frequency. There were many responses including low-amplitude waves with a higher frequency than the sample, and significantly fewer lower frequency waves with higher amplitude. A significant number of learners drew a wave with the same frequency as the sample but a lower amplitude. Frequency also tended to fluctuate in diagrams more than amplitude.

Drawings that demonstrated prior planning of where peaks and troughs would be, like dots or small lines, were much more consistent and likely to score. Annotations (such as 'λ^' 'smaller amplitude' etc.) also seemed to be associated with good drawings.

Q2(c) - Occasional problems with rearrangement, unnecessary conversions, and transcription errors occurred, but for the most part the only issue was not giving the answer to three decimal places. One of the more common errors seen was rounding down during intermediate working steps prior to the final answer, which loses the precision needed. Further practice of these types of calculations would be beneficial.

Q3(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.

Q3(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.

Q3(b)(i) – Generally completed well for both marks. A few students mistook 'refraction' for 'reflection'.

Q3(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.

Q3(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

optical fibers in endoscopes and decorative lamps
prisms in binoculars and periscopes, and vision.

Multiple correct answers in this response, scoring one mark. Note that "listing" responses should be discouraged – one incorrect response within a list such as this could risk losing the mark.

Q4(a) and Q4(b) – Most candidates were able to achieve this mark successfully.

Q4(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.

Q4(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.

Examples

Transverse waves particles vibrate perpendicular to direction of wave and can travel through vaccum and has crest & troughs while longitudinal waves particle vibrate parallel to direction of wave and can't travel in vaccum and consists of to compressions and rarefeactions

(Total for Question 4 = 6 marks)

This response scored 2 marks – the parts of response related to vibrations and the part related to wave properties were equally creditworthy.

Q5(a) – Most answers that were seen were correct.

Q5(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.

Q5(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.

Q6(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)

- put the G-M detector without a source to get background radiation
- repeat reading and get mean background radiation
- put the radioactive source infront of the detector, get reading and subtract backgrand radiation from it
- place a sheet of paper infront of detector, if reading decreased then source emits alpha that can't penetrate paper
- repeat using aluminium sheet, if reading decreased then source emits beta and can't penetrate aluminium
- repeat using lead sheet, if reading decreased little then source emits gamma / The greater the reading on counter with source the's power larger the penetration
- measure distance between source and detector using metre ruler
- make sure to keep the distance the same each time
- repeat and take average
- use tongs to hold source
- keep large distance from source

This response scored all 5 available marks: there are multiple ways of scoring marks in this question – this example scores marking points 1, 2, 4, 5, 7 and 8.

Q6(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.

Q7(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.

Q7(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.

Q7(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.

Examples:

moderator ~~that~~ helps increase rate of fission by slowing down neutrons so that nuclei can absorb slow moving neutrons and ~~m~~ ~~a~~ split, causing fission. Neutrons collide with molecules of moderator ~~wh~~ which ~~de~~ decreases the ~~neu~~ neutrons' speed and momentum until thermal ~~eq~~ equilibrium is reached. Control rods absorb neutrons released by fission reactions, decreasing rate of fission, preventing the chain fission reaction from growing larger. Control rods are made of graphite so don't become dangerously ~~un~~ unstable themselves when absorbing neutrons. fuel rods contain uranium. The uranium nuclei ~~go~~ ~~undergo~~ absorb slow moving neutrons, and split, ~~m~~ ~~on~~ causing ~~fission~~ going through fission which releases energy.

This response is one of the better responses seen, scoring 3 marks for their discussion of the moderator, and a further two for the role of the control rods.

The ~~coolant~~ coolant decreases the temperature of the reaction so it decreases the risk of very ~~over~~ high temprature so rate of reaction is controlled as high temperature increases the rate of the reaction increases and may cause an explosion.
As the moderator slows down the neutrons so there will be less frequent succesive collisions so the rate of the fission reaction is controlled.

This response scored 1 mark for the role of the moderator but included a significant misconception in relation to the outcome of this on the rate of fission.

7(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.

8(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.

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

8(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'.

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

8(c)(ii) - Some incorrect ideas seen within the report:

- lines similar to the field of a bar magnet
- helix/coil around the line
- straight lines perpendicular to the wire, either centred on the wire or starting from the wire (sometimes with arrows)
- arches with the wire as a base
- concentric circles, but not around the wire
- wiggly line like a sine wave along the wire

8(d) - Some answers were not specific enough: 'it's moving to the right' 'it's moving horizontally' 'it moves towards the magnetic field' 'it's travelling in a straight line through the field' 'it's not going against the field' 'it just moves along' and so on.

A few gave some good explanation without saying which particle it applied to.

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

9(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.

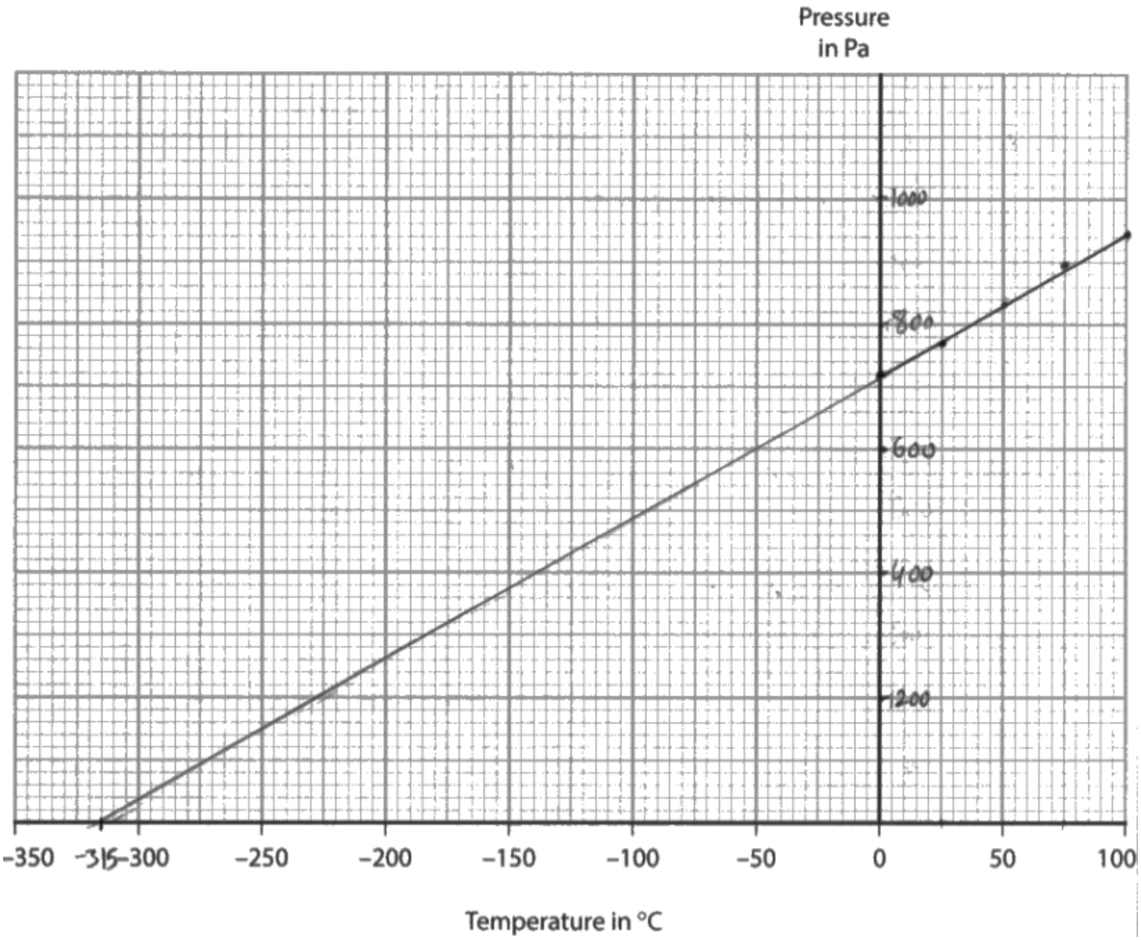
Many candidates chose a scale with a false origin to spread the points out, despite the clear instructions in the stem of the question. Some chose challenging scales to have a true origin and spread out the points as much as possible, such as 160, 165 or 175 to a large square, or 250 to 15 small squares. 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 was sufficient to score all 5 marks available across the 3 question parts: note that the plotting marks are on the borderline of an acceptable size, a neat "X" instead of a blob would be considered an improvement.

9(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.

9(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.

10(a) - The main error in this question was students being too vague and simply stating 'red shift', which was insufficient.

10(b) - Many answers scored 3 for giving the change in wavelength to 5sf, missing out the last step. Some tried to use the equation v=fλ instead. Inevitably some subtracted Δλ from the reference wavelength instead of adding it, and some rounded the answer so that there was no difference from the reference wavelength. As with previous questions, rounding intermediate working posed a problem to many candidates

10(c) – This question required candidates to identify the source of redshift – galaxies moving at different velocities, and the reason for this movement – that the universe was expanding. Candidates often picked up one of these reasons, but not the other.

Example

(2)

Because the greater the redshift, the faster movement of galaxies, so galaxies are moving away from each other which emplies an expansion from a single point.

This response scored both marking points.

Summary

Based on their performance on this paper, candidates should:

- Practice distinguishing between practical activities (e.g. sound waves vs. radioactive decay) 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 atomic structure.
- 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.

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