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Examiners' Report
October 2025

Pearson Edexcel International Advanced Level In Physics
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Introduction

The assessment structure of Unit 4: Further Mechanics, Fields and Particles is the same as that of Units 1, 2 and 5, consisting of Section A with ten multiple choice questions, and Section B with a number of short answer questions followed by some longer, structured questions based on contexts of varying familiarity.

This paper provided candidates of all abilities the opportunity to demonstrate their knowledge and understanding of Physics by applying it to a variety of contexts with differing levels of familiarity.

Candidates at the lower end of the ability spectrum were able to perform simple calculations involving substitution and basic rearrangement. However, they often struggled with multi-step calculations or those involving more complex concepts like trigonometry. Candidates should be encouraged to make sure they do complete substitutions before they manipulate to ensure they get “use of” marks. Many weaker candidates also need to practice mathematical skills such as percentages and fractions.

Candidates at the lower end also had difficulty recalling specific terms, such as "thermionic emission." They should be encouraged to ensure they can explain common concepts, such as the evidence for the nuclear model of the atom from alpha scattering, in a clear, step-by-step manner.

More able candidates generally excelled in mathematical problems but had difficulty explaining more complex concepts, such electromagnetic induction and Faraday’s and Lenz’s laws.

Most candidates communicated their knowledge of Physics clearly, even if their written English was not always perfect. Apart from * questions that assessed the structure of responses alongside the physics content, a lack of written English proficiency was not penalised as long as the answers were clear and unambiguous.

Comments on Individual Items
Section A: Multiple Choice

	Subject	Correct response	Comment
1	Electric field lines	**A**	Arrows go away from a positive charge (proton).
2	Particle equation	**D**	Conservation of charge 1e+1e→ 1e+0+? (?=+1e) Conservation of baryon number 1+1→1+1 +? (?=0) So, X must be a positive meson
3	$E_k = \frac{p^2}{2m}$	**B**	Kinetic energy is proportional to the square of momentum. If the momentum is halved the kinetic energy will reduce by a factor or 4.
4	Scalars and vectors	**A**	Capacitance is the only scalar. Centripetal acceleration, impulse and momentum are all vectors.
5	Situations where there is a relativistic effect in particle lifetime.	**C**	As the muons experience relativistic effects their lifetime increases, and their rate of decay is slower.
6	Factors influencing the e.m.f. when there is a change of current in another coil linked with this coil	**B**	Increasing the frequency means a greater rate of change of flux linkage. Separating the coils and decreasing the number of turns will reduce the flux linkage. Decreasing the supply potential will reduce the induced emf by the transformer effect.
7	Nucleon and proton numbers	**A**	Releasing a positron will keep the nucleon number the same and reduce the proton number by 1.
8	Particle accelerators	**D**	$\frac{mv^2}{r} = Bev$. As $v = \frac{2\pi r}{T}$ and $f = \frac{1}{T}$ $\frac{m2\pi f}{r} = Be$ and $f = \frac{Ber}{2\pi m}$ so frequency depends only on charge, magnetic flux density, and mass. It does not depend on velocity.
9	Impulse	**C**	The magnitude of change in momentum is $(\frac{v}{2} - -v)m = \frac{3mv}{2\Delta t}$ As the ball hits the ground the force is towards the ground.
10	Vector diagrams to derive equations for centripetal acceleration.	**D**	Acceleration is the change in velocity over time so it must be v_Q-v_P. The vectors must be going in the correct directions; the change in velocity goes towards the centre of the circle, v_P must be horizontal and v_Q must be diagonally down to the right.

Question 11

Most candidates scored full marks. Common errors included failing to provide units, giving incorrect units, or using incorrect powers of ten. Candidates who did not score often failed to square r, or did not include a full substitution such as with $k$or ε_0.

Question 12

Most of the candidates scored full marks. While any correct fraction or percentage (e.g. 0.2 or 1.2) was accepted for the first mark. Some weaker candidates were unable to calculate a percentage and instead attempted to add 0.2. The most commonly awarded mark came from using $\frac{1}{2}CV^2$. Where candidates failed to score, they typically omitted the $\frac{1}{2}$ or the square in $\frac{1}{2}CV^2$.

Question 13

Most candidates obtained the correct answer, but many lost the final mark by not making their comparison explicit. For "deduce" questions, a *quantitative* comparison is required, e.g. 3.31×10^{-25} kg $\approx 3.33 \times 10^{-25}$ kg,
followed by a conclusion such as "so it is mercury."
Some candidates incorrectly used $E = mc^2$, losing the final two marks.

Question 14

(a)
Most candidates answered part (i) correctly. Part (ii) was more challenging. Despite being asked to calculate an e.m.f., many failed to apply Faraday's law. Candidates scoring zero often attempted to calculate a time or used incorrect approaches such as $F = Bqv$ or $E = V/d = F/q$. Many successful answers used $E = Blv$; this earned full marks when evaluated correctly, but none if evaluated incorrectly. More able candidates derived the expression from first principles, allowing them to obtain method marks even if the final value was wrong.

(b)
About half of the candidates scored a mark, usually for stating that there was no change in flux linkage. The situation was difficult to visualise, and many did not appreciate that above the equator the Earth's magnetic field is horizontal, so no e.m.f. would be induced horizontally across the wingtips.

Question 15

(a)
Most candidates achieved full marks.

(b)
A majority of candidates scored full marks. Some lost marks for forgetting to state that the down and/or strange quarks were antiquarks.

(c)
Most candidates gained full marks, although a significant number lost the final mark because they did not recognise what "deduce" requires. A quantitative comparison and conclusion were needed, e.g.: 3.34×10^{-27} kg $< 5.16 \times 10^{-27}$ kg,
"so the mass of the tetraquark is greater than 2 protons". Candidates should be reminded to always include units with their answer.
A common error among less able candidates was using the electron mass instead of the proton mass.

(d)
Many candidates did not score as they paraphrased the question, writing generally about "energy" rather than *kinetic* energy, or about "making new particles" rather than an *increase in mass*. This question developed from part (c), and candidates would benefit from recognising how questions develop.

Question 16

(a)
Most candidates identified weight, although some wrote "gravity." Many named the other force as reaction or contact force. A significant number incorrectly treated centripetal force as an additional force rather than a resultant force.

(b)
Many candidates wrongly believed that centripetal force is a separate physical force rather than the resultant of weight and reaction. Among those who understood circular motion, many failed to apply it to the *minimum speed* situation and instead discussed whether water would fall out.
A surprising number believed the speed must be *lower* than the minimum speed. Although many wrote $mv^2/r = mg$, only a minority explained its significance clearly enough to gain the final mark.

Question 17

(a)
Most candidates achieved full marks. Some obtained the first two marks by attempting conservation of momentum, then became confused with the geometry.

(b)
Most candidates scored full marks. Some lost marks for not recognising that "deduce" requires a numerical comparison and conclusion. Some less able candidates failed to square the speed in the kinetic-energy equation.

Question 18

(a)
The most common error was failing to state that the pion was charged, costing the first marking point. Many also claimed incorrectly that the magnetic field (rather than the force) was perpendicular to the motion. Some gained the final mark by recognising the presence of centripetal force/acceleration causing the particle to go in a circle.

(b)(i)
This was generally well answered. Candidates could explain the neutral charge of the new particle using evidence from the bubble-chamber track or conservation of charge.
Despite the question stating clearly that the $\mu^+$was an anti-lepton, some failed to mention conservation of lepton number. Candidates should be reminded that an "Explain" command requires a clear reason. They should be using the words "because" or "so that" in their answer.

(b)(ii)
Most gave the correct answer. Some incorrectly stated "opposite charge" even though the new particle was neutral.

Question 19

(a)
The alpha-scattering question has appeared before but not recently, so it was pleasing to see many good responses.
Candidates who did not score well typically failed to express the correct hierarchy (using "some", "some" and "some" rather than "most," "some," and "very few") or did not link each piece of evidence to the correct conclusion.
A common omission was the final IC point about concentration of mass: many wrote "concentration of mass and charge" or "dense charge," which was not appropriate.
Another common error was not making clear that alpha particles were *undeflected* (First IC point).

(b)
(i) About half the candidates scored full marks. Some confused v and V, using $E_k = \frac{1}{2}mv^2$to find a velocity and then substituting into $W = QV$.
Part (ii) was generally well answered; the most common mistake was failing to square the distance.

Question 20

(a)(i)
Most candidates correctly used $Q = CV$.

(a)(ii)
Another "deduce" question requiring a quantitative comparison and a conclusion. Most could use the exponential form and scored at least one mark, though some misread the question as a 25% decrease

rather than decreasing to 25%. Those who did not score often attempted to use the time constant in an inappropriate way.

(b)
Most candidates scored at least one mark for drawing an exponential curve. Common errors included:

- Touching the time axis (the line should stay level with it).
- Not touching the current axis.
- Omitting current units.
- Drawing a charging curve instead of a discharge curve.

Question 21

(a)
The vast majority scored the mark, although some lost the mark due to spelling mistakes (e.g. *thermonic*, *thermeonic*). Common incorrect answers included ionisation, photoelectric effect, thermal effect, and thermistor effect.

(b)
Part (i) was almost always correct. Part (ii), calculating acceleration, was often correct; some attempted to use Coulomb's law to find a fictitious charge or used $g = 9.81\ \text{m s}^{-2}$. Part (iii) was poorly answered. Few candidates recognised that there is no acceleration *after* leaving the field.

Question 22

(a)
Most candidates gave the correct direction and referenced Fleming's left-hand rule (FLHR). Many lost a mark by not mentioning the direction of current. Those who failed to score often omitted FLHR entirely. A minority invoked Lenz's law incorrectly.

(b)
A significant number achieved full marks. While many used $F = BIl$, earlier marks were often lost due to not using a kinematics equation for acceleration or incorrectly calculating the force with $F = mg$.

(c)
Most candidates gained the first two marks, but few accessed the remaining three. Many mixed ideas from different marking routes—for example using Lenz's law (route 1) but then discussing induced current (route 2), or vice versa. Very few candidates explained that the induced emf opposes the battery emf and therefore reduces the current in the rod.
In route 2, candidates often failed to link the induced current to its own magnetic field and the opposing force. In both routes, only a minority clearly explained why the resultant force on the rod becomes zero.