Examiners' Report/
Principal Examiner Feedback

January 2016

Pearson Edexcel
International Advanced Level in
Physics (WPH04)
Paper 01: Physics on the Move

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General

This paper gave students the opportunity to demonstrate their understanding of a wide range of topics from this unit, with all of the questions eliciting responses across the range of marks. Some parts of questions were particularly aimed at the higher achieving student but it was encouraging to see that these questions were attempted by all students and marks gained. In the more descriptive answers, students often did not score full marks because they did not use appropriate terms and therefore could not give a clear unambiguous answer.

Section A – Multi-choice questions
it was still not uncommon to find no response given to one of the questions.

Questions 1 – 10

There was a range of responses to these questions with question 2, 3 and 4 causing the most difficulty.

Question	Topic	Correct Answer	% Correct	Common wrong answer
1	The Farad	A	87	-
2	Electric field strength	D	40	B
3	Circular motion	D	43	C
4	Electrostatic forces – application of Coulombs law	B	22	D
5	Electric field strength between parallel plates	C	72	D/B
6	Particle accelerators	C	55	A/D
7	Momentum and kinetic energy relationship	B	87	-
8	Application of a straight line graph	A	83	B
9	Particle tracks	C	87	-
10	Particle tracks	C	77	-

Question 2
Most common incorrect answer indicated that students appreciated the non-linear relationship between E and r but did not appreciate that the electric field around the negative charge is negative.

Question 3
Most common answer was chosen as the force in the opposite direction to the motion and did not make the link to circular motion.
Question 4. Answers C and D can be easily eliminated by considering the direction of the forces on the small positive charges due to each of +Q and –Q. However, the most common incorrect answer was D. An appreciation of the rapid decrease of an inverse square law with distance leads to the answer B.

Section B

In general students were able to give correct units for quantities that they calculated and it was very rare to apply a unit error.

Most students understood the convention that in the "show that" questions it was necessary to give the final answer to at least one more significant figure than the value quoted in the question.

Some questions indicated a student's failure to read through the question carefully, making sure that all relevant information was noted. In question 14(c) many students failed to make use of the equation that had been given to them in part (a). In question 16 the height of the ISS given at the beginning of the question was ignored in part (c).

Question 11

(a) Many students appeared to be attempting to answer questions from past papers about the Alpha Scattering experiment, with a number choosing to include both the observations and the conclusions, when it was only the observations being tested here. The relative numbers of particles for each of the three situations (most, some, very few) were often not well remembered by students, with a number of students using unscientific language such as "bounced off". Some students stated a correct observation, but then added extra detail that lost them the mark e.g. "Most of the alpha particles passed straight through with little or no deviation". The statement "little deviation" implies that they are not going straight through and so this meant that the mark could not be awarded. There were also some issues with what students considered to be "large angles". Those who clarified actual angles tended to prosper in comparison to those who just used "small" and "large" angles.

(b) Students are familiar with this type of calculation with over 50% scoring full marks. However, a number of common errors were seen, for example:
- use of Boltzmann's constant for k,
- omitting to multiply by 2 and 79 for the relative charges,
- omitting to multiply each charge by e,
- writing the equation correctly but omitting to square r.

Question 12

(a) The majority of students scored only 2 marks because they did not recognise the need for a complete circuit, simply re-stating what the question told us in that the current was in the coil.
(b) A number of students felt that the current produced would be of insufficient magnitude to charge the battery. A significant number of students described the current as "Alternative" rather than "Alternating".
(c) A significant number of students stated that the e.m.f. would remain the same or increase. Others did not even address the change in e.m.f. requested. It may be that students were using a previous mark scheme to answer the question about regenerative braking and not applying the Physics to the context of this question.

Question 13

(a)(i) Students had the correct idea about the movement of electrons but were unable to explain the flow of electrons without making it ambiguous as to whether they passed across the gap between the plates. For the second mark the most commonly seen response was that the p.d. across the capacitor was equal to that of the cell.

(a)(ii) Generally well-answered, although the common mistake was to use ½ QV with an assumption that Q was the capacitance.

(b)(i) Most of the students who recognised that current decreased also picked up the idea of exponential. A large number of students just talked about current stopping, without any mention of a decrease (gradual or not). Most students who drew a sketch graph to visualise this (which could score the first marking point) also described the decrease in words anyway.

(b)(ii) A generally well answered question with around 50% scoring full marks.
Common mistakes:
Use of 10.8V instead of 1.2V in the exponential equation.
Use of 10.8V or 1.2V in linear equations, which usually progressed in a 3 step method from Q=VC, to Q=It and then R=V/I. These often picked up MP2 for the use of 1.2V with 25 seconds.
A significant number had all the correct numbers in the exponential equation but then did not calculate the correct answer.

Question14

(a) Although most students had the right idea for this, quite a lot did not state that QV was an equation for energy. A significant number also thought it necessary to start their working with r=mv/BQ, perhaps as this seemed to have the m/Q expression they were looking for on the left hand side of the equation. However, most of these students did not score any marks here. A few used electric field strength equations with later substitutions to arrive at the same answer.

(b) Few students scored full marks most commonly making no mention of the magnetic field and so not scoring MP1. A lot also said that force was perpendicular to field without mention of the direction of motion of the ions. Many said resultant force instead of centripetal force for markimg point 3, although this was a mark that was generally awarded quite often.

(c) Many students did not feel any need to use the equation from part (a) in order to help them with this calculation. A lot of these students scored 0, as just jumping to the equation r=mv/BQ left them with the issue of having no velocity value (some simply used the speed of light, whilst others who were more confused used the potential difference value of 3000V as a velocity). Quite often the mass was used correctly at the end of their calculation but not at the beginning. Also a number of students seemed to want to use an 80x ionised particle instead of a singly ionised particle.

Question 15

(a)(i) This question was not answered well. Most of the discussion was usually focusing on whether circular motion was taking place or whether there was vertical as well as horizontal motion taking place. A large number of students were talking about velocity in relation to the person bowling the ball i.e. ball not moving at B as the man is still holding it, moving at C as the person has let go. In addition, there was a number of answers about whether there was a resultant force or not in each position, which was not really answering the question.

(a)(ii) A very well answered question with nearly 90% scoring full marks.

(b)(i)-(ii) A majority of students achieved the correct answer for part (i). Most common mistake was incorrect resolving or not resolving at all. An incorrect answer was carried forward to part (ii). Students generally realised the need to compare kinetic energy before and after although, interestingly, a common mistake was to treat kinetic energy as a vector and resolve the velocities.

Question 16

(a) This part was generally answered well although a significant number were not able to convert 24 hours into seconds.

(b) The link between direction, velocity and acceleration was often not clearly made losing 1 or 2 marks. Most commonly scoring mark was mention of a centripetal/resultant force. Marks were often not awarded due to poor expression.

(c) The use of the correct equation(s) was generally well known although it was not uncommon to see students using their value for ω from part (i) as a velocity in $F=mv^2/r$. A large number of students failed to add on the height of the ISS above the surface of the Earth for r.

Question 17

(a) The majority of students did not recognise the presence of 2 forces in this situation, and had an arrow downwards for the field on their diagram. Most commonly students were awarded 2 marks. Those who recognised that there was a different force on the magnet/yoke than the rod tended to score all 3/4 marks.

(b) A high scoring question with most students achieving at least 4 marks. Students realised that this involved $F=BIl$ and finding a gradient to determine B. A wide range of graphs were suggested and use of their graph to determine B was interpreted correctly. Least commonly scoring mark was to state "measure the length of the rod in the magnetic field" with some lazy statements made, such as simply "l=length of rod in magnetic field" and "measure the length of the rod" which failed to score the mark.

Question 18

(a) Generally well done, although some students thought that the positron and/or neutrino contained quarks. This error meant that they could not be awarded a mark for the proton and neautron quark content.

(b) Most of the mistakes here tended to centre around two issues:

Omitting that the charges of the neutron and neutrino.

Not stating that charge was conserved.

(c) This was a low scoring question with the majority of students not scoring any marks. It is clear that they don't entirely understand mass-energy equivalence and have a real problem using the sum of rest-mass energy and KE using only 1.58 MeV or ignoring the kinetic energy of the positron. Also the best advice to give students is that you should only ever use the de Broglie equation when the question uses the words "de Broglie". All students who used this equation scored zero marks. Even for those calculating the mass/energy correctly at the start, many then put it into a de Broglie equation which is not correct.

(d)(i) On the whole this was well done, although a significant number of students did not to use the equation that was given in the question, using $E=mc^2$ instead.

(d)(ii) Most of the incorrect responses here seemed to be either talking about annihilation or the alpha scattering model. Of those mentioning deflection they were then not able to explain why the electrons were deflected. Similarly those who mentioned diffraction failed to make the link with wavelength and size of gaps between, or diameter of, protons/quarks.

Summary

It can be seen through the answers that students practice with question papers and mark schemes from previous series.

Students should read the stem of the question carefully and answer correctly the question asked.

Students should also pay attention to data in the stem of a question.

Equation to be used correctly.

Grade Boundaries

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