Pearson

Edexcel

Examiners' Report

Principal Examiner Feedback

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In Physics (4PH1) Paper 1PR and Science (Double Award) (4SD0) Paper 1PR

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Introduction

As in examinations for previous specification, most students were able to recall the equations and usually they handled the related calculations well. Students who gave the best practical descriptions usually appeared to be writing from first-hand experience. Responses to the longer questions showed that the less able students tend to struggle when assembling a logical description or when asked to offer more than one idea. There was a wide range of responses and it was good to see that many students could give full and accurate answers.

Question 1

Many candidates correctly matched the situations with the appropriate energy store in this intentionally straight forward question. The most common errors were to assume that a car moving horizontally reduced its gravitational energy store or that a splitting nucleus reduced its elastic energy store. Questions 1(b)(i) and item 1(b)(ii) were also correctly completed by the majority of candidates.

Question 2

Question 2(a) proved challenging to most candidates. Many candidates correctly named a portion of the visible spectrum for thermometer R. Any colour between red and violet was accepted. The start of the question makes reference to electromagnetic radiation just beyond the visible spectrum so responses such as microwaves, radio waves and X-rays were not accepted.

Questions 2(b) and 2(c) were rather more successfully answered that item 2(a) and the equivalent item in previous series, showing that candidates are getting better at recognising which thermal energy transfer is important in a given situation.

Question 3

Nearly all candidates correctly mentioned comets and planets as the types of object X and object Y. The calculation in item 3(c) showed candidates using the supplied formula well with the only obstacle to a complete solution being the conversion of 35 days into seconds so as to give the orbital speed in the required unit of metres per second.

Question 4

Question 4(a) showed that the majority of candidates confused the idea of control variables being necessary a fair test with those of accuracy and precision. Question 4(b) again was better answered with more candidates than in previous series making the link between a straight line of best fit *going through the origin* being the indicator of direct proportionality. No marks were awarded for responses in question 4(b)(ii) for an answer of -273 ^{o}C without evidence of extrapolation of the line of best fit on the graph to the temperature axis. Question 4(b)(iii) required answers in terms of ideas about particles however many candidates did not make clear that it is the interactions of the particles with the walls of the container that causes pressure.

Candidates performed the calculations well with the exception being the conversion from ^oC into kelvin.

Question 5
Candidates performed the calculations in questions 5(a) and 5(b) very well. Rather fewer made the link from the soft material at the front of the toy car to an increased collision time and hence a lower deceleration and less steep graph.

Question 6
This question was performed well, in its entirety, by the majority of candidates. Use of a protractor and the refractive index formula linking angles of incidence and refraction were particularly impressive.

Question 7
Candidates described the relationship between pressure and volume well, especially i they referred specifically to the changing steepness of the curve. The calculations in questions 7(a)(ii)-(v) were completed with significant skill. Follow on credit was awarded in 7(a)(v) provided that the candidate used their answer from 7(a)(iv).

Most candidates followed the instructions and drew only two arrows for item 7(b). Any extra arrows prevented the awarding of the third mark.

Question 8
The quality of magnetic field line pattern diagrams has continued to improve over time. The best diagrams for item 8(a) were clear and showed lines from the short ends of the magnet which give a symmetrical pattern. This can be achieved with four field lines, as indicated by the question itself.

As in previous series, no credit was awarded in question 8(b) for reference to an induced current. The simplest way of explaining this effect is by reference to a 'cutting of field lines' by the conducting wire although higher order answers were acceptable.

Question 9
Explaining the Doppler effect was first examined in the Summer series of 2019 on paper 2P. The mark scheme for that question sets out carefully a full description of how the Doppler effect arises. Ideas about changes in loudness or intensity as heard by student A, or the sound heard by student B were ignored as the question is about the frequency heard by student A. It is always a good idea to use an equation where possible as additional information. In this case, the wave equation **speed = frequency × wavelength** is relevant. By stating what is constant in the equation (here the speed of the waves not the speed of the buzzer) and what changes (the wavelengths of the waves increases) it is clearer what the result of that change is. In this item, that means that the frequency of the waves at A is lower.

Question 10
Many candidates correctly calculated the number of released neutrons in item 10(a). Common errors were forgetting to include the neutron on the left side of the equation and adding a neutron on the right-hand side as well as the 'x'.

The most successful responses for question 10(b) described a chain reaction as a process that affects the uranium nucleus rather than the whole atom.

Question 10(c) was expertly answered by those candidates who attempted it in a variety of different ways.

Question 10(d) required responses relating to the long half-life of radioactive waste.

Question 11
Numerical work in part 11(a) was completed again with excellent mathematical skills. Very good answers to item 11(a)(iv) described the role of friction doing mechanical work increasing the thermal energy store of the block, ramp or air.

Question 11(b) was a different context and as such was marked generously. Many students had got the right idea about the less steep ramp scenario requiring less force to lift the block and that the jounre would therefore necessarily be longer. The best responses used appropriate scientific language and made comparisons between the GPE required and the increase in mechanical working required to achieve that gain in GPE.

Question 12
Questions 11(a)(i) and 11(a)(ii) were completed to a high standard, provided that the candidate could recall the correct symbols for an ammeter, a cell and a resistor. Common errors were to put the voltmeter in series with the variable resistor or across the fixed resistor.

Question 11(b) proved challenging, although similar questions have appeared in all series of this specification. It is a misconception that 'current in series are the same' as this implies that in any series circuit, if a change occurs then the current remains the same. This is not true. Usually, if a candidate realised that the total resistance of the circuit increased and so the current decreased their overall response merited most of the marks available.

Graph plotting, in general, was excellent. Some candidates missed out the point at the origin. Others insisted on putting the line of best fit through the origin even though that gives an uneven distribution of points above and below the line.

Summary Section

Based on the performance shown in this paper, students should:

- Take care when drawing diagrams to add labels and draw accurately.
- Either build or simulate circuits in which the number of components changes and noting the effect on the currents and voltages in or across those components.
- Ensure that they have either seen or performed the practicals named in the specification where possible.
- 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 equations listed in the specification and be able to use them confidently.
- Recall the units given in the specification and use them appropriately, for instance frequency.
- Be familiar with the names of standard apparatus used in different branches of physics.
- Practise structuring and sequencing longer extended writing questions.
- Show all working so that some credit can still be given for answers that are only itemly correct.
- Be ready to comment on data and suggest improvements to experimental methods.
- Take care to follow the instructions in the question, for instance when requested to use particular ideas in the answer.
- Take advantage of opportunities to draw labelled diagrams as well as or instead of written answers.
- Allow time at the end of the examination to check answers carefully and correct basic slips in wording or calculation.

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