Examiners' Report
Principal Examiner Feedback

January 2022

Pearson Edexcel International GCSE

In Physics Science Double Award (4SD0)

Paper 1PR

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General Comments

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

Most candidates correctly spotted how to calculate the correct number of neutrons in a nucleus and that gamma radiation can be described as a high frequency electromagnetic wave. Candidates have become more adept at spotting which variables are the independent and dependent variables in investigative science although are less able to pick out which variables, from a list of relevant ones in a particular investigation. Most commonly, they mixed up control and independent variables.

Question 2

By far the most common uses for x-rays and gamma rays were medicine-based although there were plenty of viable alternatives that were given credit, even if they weren't listed explicitly on the mark scheme. Calculating wavelengths from a given speed and frequency was challenging here, as both numbers were given in standard form and learners commonly gave an incorrect power of ten. In the final part of this question, very few candidates picked the correct graphical representation of the relationship between the frequency and wavelength of electromagnetic waves, even though the correct answer was the only one in which the frequency decreased when the wavelength increased.

Question 3

In parts (a) and (b) most candidates articulated the correct physics i.e. that like poles repel and that plastic is non-magnetic, although there were a sizable fraction that thought that electrical insulators are also non-magnetic. Field line pattern diagrams were generally over complex – the question only required field lines in the region between the magnets. Teachers should remind leaners that field lines never cross and never start all at the same point i.e. lots of field lines all appearing from the letter 'S' on the diagram. Part (d) brought an unfamiliar context which was answered well by many. Commonly, candidates assumed that as magnetic forces are non-contact in nature that the balance readings couldn't be affected.

Question 4

The majority of candidates were comfortable describing the difference between scalar and vector quantities although broadly fewer could articulate the similarity i.e. that both quantities have magnitude. In part (b), commonly candidates would select acceleration and weight as scalars and not charge. This is possibly because charge can have a sign, just like a force. Likewise, confusion between mass and weight may explain why many thought weight is a scalar. Part (c) was successfully answered by the majority, although some added all four numbers together or restricted themselves to consider only the vertical forces as part of the resultant.

Question 5

Parts (a) and (b) showed that candidates find ideas about efficiency challenging. It is helpful for candidates to relate the total output energy to the useful output energy.
In part (c), a sizeable minority of candidates missed the 'nuclear' descriptor and suggested a range of fossil fuels, when the name of any fissile element was acceptable regardless of the isotope given i.e. 'uranium' was perfectly acceptable. The specification refers to an increase in the kinetic energy store of the fission products, rather than the commonly provided response of 'nuclear' and that the nucleus splits because it is unstable. Rather more candidates correctly identified the cause of the fission is neutron absorption and that the smaller nuclei are referred to as 'daughter nuclei'.

Question 6

Part (a) was answered well with some candidates getting the hottest two stars muddled. Part (b) was answered slightly less well however many learners scored three marks for references to gas in the nebula compressing due to gravitational attraction causing fusion to begin. Part (c) was answered considerably less well, possibly due to the required detail being more than has been asked in the past.

Question 7

The majority of candidates scored well here – it was evident that many had either performed this themselves or had seen it performed online. Some of the marks were often awarded because of a high-quality diagram on which is was obvious which angles the candidate intended to measure and that they should measure from the normal. In addition, learners provided responses that clearly fell into the two required categories in part (b).

Question 8

In part (a), many responded correctly that the wave behaviour was reflection. Rather fewer remembered to take this into account in the distance calculation in part (a)(ii). Some candidates attempted to include the frequency of the sound waves into the calculation which was not required. Others mistook the 'm' prefix combined with the SI unit of time 's' to mean 'minutes' or got the wrong power of ten for 'milli-'.
Most candidates scored 1 mark for part (b)(ii) because the identified that the lower the frequency the high the penetrating ability of the waves. Very few referred to all waves decreasing in amplitude with increasing distance or used data to support their observations.

Question 9

The majority of candidates correctly transposed the LED circuit symbol to the correct branch of the circuit and drew the required ammeter in series with the cell. A tiny proportion drew the LED in the correct orientation i.e. that allowed conventional current to pass through R_1. Rather more (although still the minority) correctly suggested that the voltages across the cell and R_2 were the same because the two components are in parallel. Part (c) was answered well by most leaners, especially if they referred to a valid way of changing the current in part (c)(iii).

Question 10

Part (a) showed that candidates remain very good at some complex calculations particularly in item (a)(i) and less so in item (a)(iii). In item (a)(iii) many learners used the difference in speeds and then assumed that was the speed throughout the ball's motion. Had they used the *average* speed between points A and B, they would have been successful. Most successful responses referred to the relevant formula on the formula page and used the acceleration from item (a)(i). Responses to item (a)(ii) were largely over-complicated with few quoting that the acceleration would be smaller due to a smaller resultant force due to the presence of drag or friction opposite to the direction of travel of the ball.
Students plotted the graph will in part (b) with some excellent curve-sketching skills. The final item in part (b) only required reference to the idea that the gradient of a distance-time graph gives the gradient and that the gradient of this graph is increasing.

Question 11

Most candidates could correctly calculate the volume of the air inside the tyre at the higher pressure by using the supplied formula. Many, however, missed the instruction to give the answer in standard form.
In part (b), candidate should remember that the particles reduce their kinetic energy so that the collisions with the walls of the container are more less frequent and with less force. Collisions between gas particles themselves are irrelevant. The calculation was performed carefully by many, especially if the candidate remembered to convert the temperatures to the kelvin scale.

Question 12

A common misconception of thermal energy transfer is that it is a difference in energy between two regions that causes a net transfer of energy, when in fact it is due to a difference in temperature. Parts (b) and (c) showed many learners remembering key facts about conduction and convection.
A further misconception was apparent in part (d). Many candidates correctly chose white as the colour to paint the inner surface yet forgot that the energy transfer was towards the cold food from the hotter outside. This meant that the correct property of the inner surface was that it should be a poor emitter.

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.
- Structure multi-step calculations as simply as possible to facilitate checking at each stage.
- 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 partly correct.
- Signposting working with words may help with structuring calculations clearly.
- 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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