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Examiners' Report/ Principal Examiner Feedback

Summer 2010

IGCSE

IGCSE Physics (4420) Paper 2H

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Question 1

In (a), many candidates scored the mark for identifying the component although a large proportion were helped by the mark scheme allowing light emitting diode (because of the diagram printed in question 12). Candidates should be warned that future mark schemes may not be so generous. Incorrect answers included resistor, variable resistor, thermistor and LDR. In (b), many candidates explained the difference, mainly in terms of resistance, although some failed to state what could or could not be changed e.g. a fixed resistor can't be changed but a variable resistor can. Other answers showed a complete misunderstanding of these two components e.g. 'A fixed resistor is for direct current while a variable resistor is for alternating current.' and 'A variable resistor can be moved around the circuit while a fixed resistor has to stay at a certain place in the circuit.'. In (c), most candidates scored well with marks occasionally being lost for either power supply in c(i) or an incorrect voltage, usually 3.8 V, in c(iii). A majority of the candidates appreciated that current remains the same throughout a series circuit and so scored the mark in (d). However, some gave both readings as 20 mA while others gave one as 20 mA and the other as 10 mA.

Question 2

In (a), most of the candidates who read off the correct reaction time managed to calculate the correct braking time. However, there were some arithmetical errors made e.g. 6.0 s – 1.6 s = 4.2 s. In b(i), most candidates referred to the time being longer although some simply stated that the driver's reactions or even the reaction time would be slower. Fewer candidates appreciated that this would have no effect on the braking time. Almost all candidates gave an acceptable answer in (c). Those who didn't often gave answers that either were not related to the road conditions e.g. using a mobile phone, or were features that would not have increased the stopping distance e.g. a dry road. Some candidates did not add an arrow to the diagram in d(i) while others drew it, or several, in the wrong place. Most students scored the mark in d(ii).

Question 3

In (a), only about 30% of candidates identified distance c as twice the amplitude while nearly three times as many identified distance d as the wavelength. Well over half the candidates were able to do the calculation in (b) although a number obtained an answer of 2 Hz. Other incorrect answers included '$f = 1/T = 1/30 = 0.033$ Hz', $f = 1/T = 1/60 = 0.016$ Hz' and '$f = 30 \times 60 = 1800$ Hz'. In (c), a majority of candidates identified the wave as being transverse and also gave an acceptable description of the vertical motion of the ball. Those who failed to score the second mark, often did so by either stating that the ball only moved horizontally or that it just moved up.

Question 4

In (a), the reference to ‘oil-burning’ in the stem confused many candidates into stating that the oil has heat, rather than chemical, energy. The other two subparts were well answered. In b(i), several candidates gave the useful energy transfer in the turbine rather than in the pipe and so lost both marks. Most candidates scored the wasted energy mark in b(ii).

Question 5

There were a very large number of blank answers to (a). Incorrect nucleon numbers included 8, 12 and 20. Some of those who knew it should be 14 failed to write it in the correct quadrant. A number of the answers to (b) were not precise enough to gain the mark, e.g. referring to the number of protons in the atom rather than the nucleus. Both (c) and d(i) were well answered. However, only about 10% of candidates scored the mark in d(ii) with most candidates simply using any word related to radioactivity which came to mind, e.g. decay, fission, gamma, half-life and radioactive. The most common correct answer was random although a few really good candidates stated both random and spontaneous.

Question 6

This question was often badly answered. In (a), only about half the candidates could name the device as an electromagnet; the most common wrong answer being a solenoid. In (b), many thought the insulation was to prevent electrocution from the low voltage supply while others suggested it was to prevent heat escaping from the wire. Correct answers often scored one mark for preventing a short-circuit but failed to give sufficient detail to score a second. In c(i), some candidates showed that the circuit, rather than the device, was working by adding either a lamp or an ammeter. Others used a magnet to carry out an attraction test without appreciating that this would still give a positive response with the switch open. Many answers referred simply to seeing if the nail would attract another metal object. In c(ii), those explanations that included either switching off or removing the nail from the coil often failed to state how this showed that the iron was magnetically soft.

Question 7

This question was generally well answered with many candidates scoring full marks in (b). A number of candidates stated, in (a), that electrons were somehow being transferred either from or to the wall while the balloon was being rubbed by the cloth. The third mark in (a) also proved somewhat elusive for some candidates.

Question 8

In (a), nearly 90% of candidates recognised the description in the box as referring to a solid with ‘ice’ as the only possibility. The processes of melting and evaporation in (b) were also well known. However, despite the clue in (a), candidates were not so good in (c) at completing the description of a liquid as having particles in a close-packed irregular structure. Answers often suggested that the particles in a liquid are not close-packed although many candidates still scored the mark for random.

Question 9

Despite the instruction to put a cross in two boxes in (a), many candidates only put a cross in one of the four boxes. In (b), a majority of the candidates realised that the arrow was representing electron flow and most of these then gave reasonable explanations of why it did so although some stated that the electrons were travelling from positive to negative. Most candidates scored at least one mark for adding the meters to the circuit diagram. A common error was either connecting the voltmeter directly into the series circuit or connecting the ammeter in parallel to one of the wires. The calculations in (c) were generally well attempted. The most common error was forgetting to convert time to seconds but, with the e.c.f., candidates could still gain 3 of the 4 marks.

Question 10

In (a), most candidates knew that the dotted lines were normals. Fewer, but still a majority of, candidates could state the relationship in (b). Incorrect answers fell into two categories; those who forgot to include 'sin' in their answer, e.g. $C = 1/n$, and those who did not understand what was required, e.g. the greater the critical angle the greater the refractive index. In (c), many candidates scored the marks for describing both refraction and total internal reflection. Unfortunately, despite the instruction to do so, several answers did not include any reference to the critical angle. Less than 50% of the candidates scored the mark in (d). Despite stating a correct relationship in (b), many candidates blamed the lack of a refracted ray while others showed their misunderstanding of the two situations by stating that there are two critical angles to choose from. Good answers went straight to the point, e.g. 'the critical angle is not known' and 'none of the angles on the diagram are the critical angle'. Many candidates were helped by the mark scheme allowing the refractive indices for both directions of travel and scored all 3 marks in (e). Those failing to do so usually calculated the ratio of the angles rather than that of their sines.

Question 11

Most candidates successfully calculated the gravitational potential energy in (a). The most common error was finding the product of just the mass and the height. In (b), most candidates appreciated that reducing the height by a factor of two would mean that the ball would lose half of its original gravitational potential energy and so would have half of it remaining. In b(iii), many candidates did not recall the equation for kinetic energy and attempted to use other, unsuitable, relationships, e.g. speed = distance/time. Only the stronger candidates were able to use the correct equation but many of these did not read the question carefully and calculated the speed that the bar would have had if it had fallen the whole 2.5 m.

Question 12

Unfortunately, many candidates did not understand what was required of them in some parts of this question. There were some very good, text-book answers in (a). However, there were also many showing a lack of understanding of electromagnetic induction, e.g. references to the magnet cutting the magnetic field of the solenoid. In (b), many candidates did not restrict themselves to just the downward movement of the magnet and therefore wrongly stated that it produced a.c. However, many either knew that diodes only let current through in one direction or realised that the diodes were facing opposite directions. Several thought that the second one did not light as the induced current was too low. There were also many references to alternating current in (c) as candidates described the purpose of the two LEDs rather than just the other one. Several thought it was there just to prove that diodes only conduct in one direction while others thought its purpose was to act as a spare in case the other one 'blew'. In (d), too many candidates thought the LEDs wore out or that the current caused a temperature rise which produced an increase in their resistance. Only really good candidates were able to link the reduced brightness to the reduction in the solenoid's rate of cutting of the magnetic field. Unfortunately, (e) gave little guidance as to what was expected of the candidates. This resulted in some very vague statements although, surprisingly, some very good answers were also seen.

Question 13

Most candidates correctly calculated the weight in (a) although some converted the mass to grams while others used $W = m/g$. Candidates also scored well in (b), some being assisted by the fact that the weight arrow could start from anywhere within the ball and also that any up arrow within the width of the ball could score. However, some candidates still managed to lose the first mark by not labelling their weight arrow as instructed. The most common marking point scored in (c) was that for the idea of balanced forces. Good candidates tended to pick up at least one of the other two marks. Weaker candidates tried to treat speed as a force, e.g. it reaches a constant speed when the upward air resistance equals the downward speed.

Question 14

In (a), it was rather worrying to observe that a number of candidates thought it was safe to have the fuel rods sticking out of the reactor. Candidates usually scored 1 mark in (b) as most could state two correct materials while very few could state all four. Confusion between boron and barium was occasionally seen.

The description in c(ii) was completed well by many candidates who were able to gain at least 3 of the 4 marks. Weaker candidates described the atom splitting rather than the nucleus. A significant number of candidates thought that electrons, protons or alpha particles were fired at the nucleus and then released in place of the neutrons.

Question 15

In (a), many candidates gained the nucleus mark but failed to show orbits for the electrons which they often drew dotted about in a similar way to that shown in Figure 1. Other candidates lost marks by not labelling the diagram as instructed. In b(i), many candidates lost the mark by just stating that the alpha particle passed straight through or that it didn't hit the nucleus without giving a reason. Some referred to the alpha particle passing through empty space rather than stating that most of the atom was empty space. In b(ii), the path of the alpha particle was drawn correctly by many candidates. There were a wide range of paths drawn by those who failed to gain the mark which included drawing the path as a wave and drawing it deflecting either before entering the atom or beyond its centre. Correct answers in b(iii) concentrated on the positive charge of the nucleus.

Question 16

More than 80% of the candidates calculated the correct resultant upward force in (a). Many candidates also achieved both marks in (b). Candidates who explained in (c) that a scalar quantity was 'a quantity with no direction' scored only the second mark as, by using the word 'quantity', they were simply repeating the stem. Some candidates got completely mixed up and stated that a scalar quantity has direction but no size. Almost 90% of the candidates scored the mark for vector in (d).

Question 17

Although a large proportion of the candidates scored the mark in (a) for 200 K, they often then failed to use this value in their calculation in b(i). Some of those that did then raised the temperature to 50 °C rather than reducing it by 50 °C. Good candidates used the correct temperatures in kelvin and processed the data to achieve the correct answer. Many candidates could state at least one acceptable assumption in b(ii). The most common errors in this part were to state that pressure and temperature were constant. Some candidates also tended to effectively repeat their assumptions e.g. 1: Volume of the gas constant. 2: Volume of container constant. Surprisingly, in c(i), some candidates marked the value of absolute zero at the top right-hand end of the curve. Others positioned it vaguely at the origin and did not show it clearly as the zero of the temperature scale. Despite this, more than 70% of the candidates scored this mark. In c(ii), most candidates referred to the graph either not being straight or being curved. A few lost the mark by simply writing 'the gradient' as their answer without any further explanation. In c(iii), very few referred to kinetic energy and even fewer to average kinetic energy. Most candidates showed that they had not read the question carefully by stating either pressure or volume, both properties of the gas rather than its molecules.

PHYSICS 4420, GRADE BOUNDARIES

Option 1: with Written Alternative to Coursework (Paper 3)

	A*	A	B	C	D	E	F	G
Foundation Tier				63	50	37	25	13
Higher Tier	79	67	55	44	33	27		

Option 2: with Coursework (Paper 04)

	A*	A	B	C	D	E	F	G
Foundation Tier				67	53	39	25	11
Higher Tier	81	70	59	48	36	30		

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demand of the question paper.

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