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IGCSE Physics (4420)

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Examiners' Report

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PHYSICS 4420, CHIEF EXAMINER'S REPORT

Paper 1F

General Comments
Questions 1 to 8 only appear on this Paper. Questions 9 to 16 are questions in common with the Higher Tier Paper. All the candidates entered for the Foundation Tier had entered what was, for them, the more appropriate tier.

Question 1
In part (a) most were able to complete the equation for average speed and part (b) was generally correct. However in part (c) most could not make three correct statements about the motion in part E and many seemed to think that the car must be moving to a stop.

Question 2
This question was generally well answered but some candidates were muddled about the energy changes in parts (a)(i) and (ii).

Question 3
This question was generally well answered though some could only manage (b)(ii) and (iii) where common sense was helpful.

Question 4
This question on the parts of the electromagnet spectrum and their uses and dangers was well answered.

Question 5
This question was usually poorly answered especially part (c) with few candidates who could convincingly show that the waves would have the same wavelength but a greater curvature after passing through the gap.

Question 6
Most obtained some marks for this question on magnetism but the term 'induced' was not generally known and few could explain, in part (b)(iii), their answer for part (b)(ii).

Question 7
Some candidates showed little knowledge of the nature of atomic structure, of isotopes or of radioactive decay even though this question only required basic understanding.

Question 8
Candidates who had demonstrated some understanding in the previous question were generally able to gain some marks here. Unfortunately the converse was also true.

Question 9
Some were able to correctly suggest '$500 = F_1 + F_2$' in (a)(i). In part (a)(ii) the answer is the same though some seemed to think that they would need to rearrange the equation. In part (a)(iv) only a minority realised that they had to assume that the beam has no weight. Some correctly suggested 'clockwise' and 'anticlockwise' in part (b).

Question 10
Most realised that the components must be arranged in parallel. In part (a)(iii) 0 and 9 were often suggested rather than the more thoughtful 1 and 8. In (b) only a minority recognised that X is a variable resistor and that it can be adjusted to reduce the resistance and thereby increase the current.

Question 11
Generally well done but the prompt '..full name..' usually failed to generate the response of 'total internal reflection' in part (b)(ii).

Question 12
Generally well answered but many failed adequately to explain, in part (c) that the student is trying to block out other sound which may distract her.

Question 13
Generally well answered but only a minority correctly suggested that the force of friction acts at the hinge as the lid opens.

Question 14
In general candidates did not understand that, for the particles, there is no movement of any sort at -273 ˚C nor could they state the temperature at which the kelvin scale starts.

Question 15
This question on the transformer was not generally well answered. In particularly candidates could not explain why coils of **insulated** wire are used and did not know that the alternating input voltage produces an alternating magnetic field in the core.

Question 16
This question on nuclear radiation was not generally well answered. Some correctly chose beta radiation in (b)(i) but only a small proportion could offer a sensible explanation in (b)(ii). Some suggested in (c) that the reading would be lower but very few suggested that the reading would be reduced to just background radiation and many incorrectly suggested that there would be no reading.

Paper 2H

General
Questions 1 to 8 were common to this Paper and the Foundation Tier Paper. Much of the content of Questions 9 to 18 was from the 'Higher Tier only' parts of the specification.
Some very good work was seen from a small entry with nearly all candidates entered for the correct tier.

Question 1
In part (a) candidates were shown a heavy sack of weight 500 N hanging from one of three hooks in a beam. The beam was supported by two walls. The upward forces F_1 and F_2 acted on the beam. Candidates were asked in (i) to write an equation linking the three forces. There were hardly any correct answers. When the sack was moved to another hook the question was repeated in (ii). Those candidates who answered correctly in the first place did not have the confidence to repeat their answer for the second part.

By contrast in (iii), when the sack was moved to the central hook many candidates knew that F_1 and F_2 would both equal 250 N. Some even gave the correct equation here but it could not be credited with the marks for (i) and (ii). Many answers in (i) and (ii) featured **A**, **B** and **C** which were the three positions of the hooks.

Question 2

Given that seven LEDs could be switched on separately most candidates knew that they must be connected in parallel. When asked which digits needed the lowest and highest power respectively many candidates answered incorrectly with 0 and 9 being numerically the smallest and largest digits.

Question 3

This question scored well. Candidates were asked to describe the reflection from a pair of prisms and mirrors respectively by drawing appropriate rays. This was accurately done with almost all candidates using a ruler. Asked for the full name of the process involving the prisms some candidates merely stated 'reflection'.

Question 4

This question, which required drawn lines to show the direction of reflected sound waves, was poorly answered. Sound waves travelling down a tube from a source of sound (a ticking watch) were reflected from a flat surface towards and through another tube. This second tube was to be chosen from five available tubes only one of which was in a position to see the law of reflection obeyed.

Common errors apart from candidates choosing the wrong tube were :

(i) to see drawn lines going to more than one tube and

(ii) not showing the lines going through the tubes or their direction.

Part (c) in which candidates were asked to give a reason why a student listening through the second tube would put a finger in one ear was largely misunderstood with very few stating that other sounds would be blocked especially that coming directly from the watch.

Question 5

This was well answered. Candidates knew the correct relationships between force, pressure amount of gas and temperature. In part (c) few knew that the force acting at a hinge was friction. Many gave 'moment' as an answer.

Question 6

This was well answered. Given the boiling and freezing temperatures of water and ethanol, candidates were able to give the correct state of these substances at particular temperatures and describe the motion of particles in the solid state. Asked to describe the movement at –273ºC all knew that this was absolute zero temperature but some thought that there was hardly any movement rather than none at all.

Question 7

This was poorly answered. Given a diagram of a transformer with different numbers of turns on each side, candidates did not know how to use this as a step-up transformer nor why the wire was insulated. A calculation to find output voltage given the turns ratio and the input voltage was well done.

In part (d) candidates were given the following and asked to complete the sentence :

In a transformer, an alternating input voltage drives an alternating current in the input coil. This produces a ……..in the core.

A wide range of acceptable answers was seen from the strongest candidates.

Question 8

Candidates were able to name a suitable radiation detector and most were able to identify a sample as a beta emitter giving a correct explanation for their choice.

Question 9

Given angles of incidence and refraction on a diagram most were able to calculate refractive index although a significant number used i / r. The calculated value was 1.5. When told that diamond has a value of 2.4 hardly any candidates could state what difference this would make to the path of a ray with the same angle of incidence.

In part (c) candidates were asked to add to a list of apparatus required for the determination of refractive index of glass. Many gave raybox and pins as seperate items. Other vague responses were 'torch' and 'light'. Occasionally the word 'protractor' was not known.

Question 10

Vector quantities were to be identified from a list of quantities. Acceleration and velocity were the only vector quantities listed but many candidates listed a third one usually kinetic energy. This type of question is often answered more accurately when the scalar quantities have to identified as well.

All could use $F = m \times a$ and knew the correct units for acceleration but many were unable to insert the correct value for F since it was the difference between two forces.

Labelling the forces on a falling body and explaining why it reaches terminal velocity was poorly answered here as in previous sessions.

Question 11

In part (a) many did not convert 120 minutes to seconds to find the amount of energy transferred when a current of 0.5 A passed during that time.

Given a current-time graph showing this direct current many candidates were unable to give a convincing explanation as to why it was d.c rather than a.c. with some just saying that 'the graph is a straight line'.

Almost all knew that the area under the graph represented charge.

Question 12

Shown a waveform on an oscilloscope screen with a timebase setting of
0.05 s per division and two waves covering four divisions, few determined the frequency correctly giving an answer of 20 or 5 Hz rather than 10 Hz. Whatever the answer, nearly all candidates knew whether their value was within the human audible range.

Question 13

Questions requiring two advantages and two disadvantages of resources used for large-scale electricity generation are not well answered. Statements that contradict each other or involve cost should be avoided. Some sources of information are not very helpful but a little research can produce something adequate such as the following for geothermal resources:

Advantages

Take up little space
Not dependent on weather

Disadvantages

Fixed sites
Not many sites

The graph work in part (c) was of a high standard though a few candidates used awkward scales in striving to use the entire grid.

Question 14

In part (a) surprisingly few candidates knew that kelvin temperature is not proportional to celsius temperature.

Unfortunately many also misunderstood part (b) in explaining why car tyre pressures should be checked when the tyres are cold.

The calculation in (c) using the pressure was very well done but in (d)(ii) by forgetting that a car has four wheels and not converting kPa tp Pa meant that few scored either of the two marks.

Question 15

The description of nuclear fission and the use of control rods and moderators was again poorly answered. The mention of uranium led some responses to describe radioactive decay rather than the splitting of the nucleus. Occasional use of terms like 'collisions with beta particles' and 'daughter neutrons' showed the level of confusion. Candidates were able to label fuel rod, control rod, and moderator on a diagram but, as mentioned, explanation of their use was generally not understood.

Question 16

In part (a) candidates were often not clear which terminal of the symbol for a cell represented the positive and so were unable to correctly show the direction of current in a circuit. They were more confident in using the left hand rule to identify the polarity of two magnetic poles given the rotation of a coil. The calculations in (b) were well done with a few misreading 0.080 kg as 0.80 kg.

Question 17

Short questions involving the definition of the volt are rarely understood. An enduring problem is the mixing of units and quantities in such definitions for example 'the volt is the energy per charge'. The quantity 'time' often appeared in answers.

Question 18

In part (a) candidates often did not read the question although what they wrote down about Geiger and Marsden's experiment was usually correct.

Part (b) asked for the purpose of the zinc sulphide screen, block of lead and the need for a vacuum. This was well answered although answers for the third point were often unclear often referring to 'interference effects' with the air.

Paper 3

Question 1

(a) all were able to read the measuring cylinder diagram correctly.

(b) in part (i) nearly all candidates were able to design a table with appropriate headings and the volume in cm^3 or ml and the readings in order. A small minority omitted to enter the sixth marble or failed to mention the unit for volume. Almost all labelled their graph appropriately in part (ii). They plotted the points correctly without employing 'blobs', identified the anomalous point and drew an appropriate line of best fit. Most understood that there must have been 28 cm^3 of water to start with and were able to recognise the pattern and to correctly suggest 105 cm^3 if another marble is added.

(c) Most obtained three or four marks. Marks were often lost because candidates restricted themselves to just one marble or, more commonly, because they failed to specify that you need to judge that the water initially put in the measuring cylinder must be sufficient to cover all the marbles but is not so much that it will overflow.

Question 2

(a) Almost all candidates were able to name the newtonmeter/spring balance/ newton balance, to read it correctly and to name the stand.

(b) Nearly all were able to suggest a suitable measuring device and to make an accurate measurement from the diagram.

(c) Almost all understood what was required and gave the correct answer, 130 (mm).

(d) Most completed the table correctly, plotted the points correctly and used a ruler to draw an appropriate line of best fit going through the origin.

(e) Most correctly concluded that the results show that (for loads up to about 7 newtons) the extension is proportional to the load or that Hooke's Law applies. Some lost a mark because they restricted themselves to 'the extension increases as the load increases'.

(f) A rather disappointing response from many candidates. A common suggestion was that a spring would give 'better' results or that the load should be increased in 'standard' steps. A minority made an appropriate suggestion and explained it. For example, 'take more readings (in the range 0 – 7 newtons) in order to improve reliability.

Question 3

(a) Nearly all understood how to 'read' the meniscus.

(b) Most realised that you need to measure the width of the smaller beaker, subtract this measurement from the width of the larger beaker and divide the result by two.
However some incorrectly referred to the length or circumference of the beakers.

(c) In part (i) most were able to sketch an appropriate graph which had the same starting point, which fell more steeply and which then levelled out at the same temperature. If a mark was lost it was likely to be the third of these marks.
Most understood that it is necessary to keep everything else the same so that any difference will be caused only by the difference in the thickness of the insulation.

(d) Any suitable suggestion with an appropriate explanation was credited. The most popular suggestions involved either putting a lid on the inner beaker or using a non-metal lid on the outer beaker.

(e) Nearly all got some marks, which could be obtained for; it will cool more quickly/the graph will be steeper, damp sawdust is not such a good insulator/is a better heat conductor, because (trapped) water is a better conductor than (trapped) air or for realising that heat will be lost because (some) water in the damp sawdust will evaporate.

Question 4

(a) Nearly all understood that the spirit burner is used to heat water in the beaker and this gave them their first, and in some cases their only, mark. Many did not have both the thermometer and the thermistor in the water and a significant minority made no reference whatsoever to the transistor. Many did not understand that the usual purpose of a heat proof mat is to protect the bench and few suggested how the spirit burner could be used to try to keep the water at a constant temperature.

(b) Most read both meters correctly with only a very small minority suggesting, for example, 0.63 or 4.1.

(c) Most were able to deduce that the resistance will increase.

COURSEWORK (PAPER 4), PRINCIPAL MODERATOR'S REPORT

Centres who entered candidates for the coursework option have received a report directly from the Principal Moderator.

For general comments about coursework please refer to the Moderator's Report for June 2006.

PHYSICS 4420, GRADE BOUNDARIES

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

	A*	A	B	C	D	E	F	G
Foundation Tier				60	48	36	25	14
Higher Tier	82	70	58	46	35	29		

Option 2: with Coursework

	A*	A	B	C	D	E	F	G
Foundation Tier				N/A	N/A	N/A	N/A	N/A
Higher Tier	83	71	59	47	36	30		

No candidates at foundation tier entered coursework so there are no grade boundaries for this category

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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