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Examiners' Report Summer 2009

IGCSE

IGCSE Physics (4420)

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4420 Physics Paper 1F

Question 1
Candidate performance on this question was generally good with them showing skill in reading from a graph accurately and interpreting the graph.

Question 2
Although most candidates appeared to be familiar with reflection the identification of the angle of incidence and the angle of reflection and the line as the normal was poor.
Of those who could identify the image as virtual very few could explain how they knew this.

Question 3
(a) This question produced some very vague answers but some of these managed to work around to a correct response. There were a pleasing number of well reasoned correct responses.

(b) There were a number of suggestions which showed a lack of knowledge of devices which use heat usefully.

(c) Candidates here were very clear about the thin metal wire being the pathway of electricity but a surprisingly large number showed a lack of knowledge of the energy transfer involved. Chemical energy was suggested a number of times which was disappointing.
The explanation of why fuses are used produced a wide variety of responses and candidates were often very vague in their responses. This led to them failing to score marks when a little more thought to their answer may well have resulted in a mark worthy response.

Question 4
(a) Many candidates were influenced by part (ii) in part (i) and appeared to assume that the answer should be a colour. The position of green in the spectrum was clearly well understood.

(b) This differentiated between the candidates very well. There was some clear understanding and knowledge demonstrated despite the box of words being completely irrelevant to part(i).

Question 5
The candidates in general did not seem to have an appreciation of the energy flow and the factors involved. This appeared to be more a lack of knowledge or experience of the concepts involved rather than an inability to answer the question.

Question 6
Whilst the majority of candidates were correctly able to identify the LEDs were connected in parallel many could not explain why this was so.
The suggestions for an example of a dc supply and the meaning of ac were varied and mostly inaccurate even if frequently amusing.

Question 7
It was pleasing to find a good proportion of candidates understood the atomic particles and their characteristics.

Question 8
A large proportion of candidates clearly understood the lower level concept of magnetism and its effects but a relatively low number could identify steel as magnetically hard and even fewer understood why this was so.

Question 9
Less able candidates found difficulty in selecting the correct words for part (a). However a large number of candidates showed a clear understanding of how the see-saw works and gave many different variations to express this correctly.

Question 10
A substantial number of candidates appeared to have knowledge of Hooke's Law and therefore did not perform well in this question.

Question 11
The change in the size of printing the 2 diagrams obviously caused some problems for the candidates and affected the standard of their responses. The calculation of the frequency produced most of the points scored on this question and it was pleasing to see so many good answers. The final part was very poorly answered and seemed to show a lack of understanding or possibly experience of the concepts involved.

Question 12
Candidates showed a good knowledge of heat transfer processes and frequently scored well in the calculation.

Question 13
This question was poorly answered with candidates showing a lack of knowledge of radioactivity. The calculation of half life often demonstrated that the candidates were completely unfamiliar with this topic. The variety of suggestions for background radiation were concerning. Part (c) often had answers relating to medical use of radioactivity and many candidates only were able to offer this or warfare related answers.

Question 14
The less able candidates found this question very difficult and frequently the only marks gained were for the calculation.

Question 15
Candidates generally showed a good basic grasp of the principles of electrostatics although sometimes expressing themselves so vaguely they lost marks. A good proportion clearly knew and had been well taught about the use of electrostatic charges but sadly some fell into the trap of giving other painting instances or 2 experimental examples.

Question 16
Candidates demonstrated a good basic grasp of particles in solids, liquids and gases even to the extent of drawing diagrams to back up their words. They did tend not to read (b) as a separate part and therefore lost a mark when they probably could have gained it.

4420 Physics Paper 2H

General

An incomplete list of formulae was given on the inside front cover of the paper. Parts (a) and (b) of Question 14 were not marked. As a result the paper was marked out of 115 instead of 120.

Question 1

Part (a) was not well answered and the amount of crossing out showed a degree of uncertainty. The rubber band was not always associated with Graph C and many candidates showed two lines going from or to one of the boxes.
In (b)(i) many candidates thought that the two quantities were directly proportional to each other but named incorrect pairs of quantities such as 'force' and 'length' or 'force' and 'mass' and so did not score either mark. A less common error was 'force and extension are inversely proportional'.
In (b)(ii) practically all candidates knew that Graph D represented an object that obeyed Hooke's Law.

Question 2

Part (a) showed that many candidates who understood the concepts of amplitude and wavelength were unable to answer this part correctly.
In (i) rather than state that an increase in amplitude could be achieved by increasing the height of the rope many candidates shook the rope 'harder'.
In (ii) many were given credit for 'shaking the rope faster' but not for 'moving closer to the chair'.
The calculation in (b) caused few problems except where candidates divided frequency by wavelength.
Part (c) was poorly answered with many candidates not appearing to understand the difference between transverse and longitudinal waves.

Question 3

This question was very well answered with candidates scoring 3 or more marks in part (a). Some did not correctly identify 'convection' as the fourth answer and a few used words that were not in the box such as 'decreases'.
Part (b) was usually correct although a few candidates divide by *g* and a few added another zero from somewhere to give 350 000 N.

Question 4

In part (a)(i) some acceptable spellings of becquerel were seen but it appeared that some candidates had not seen the word written down before.
The calculation in (ii) was well done although a few candidates either divided or multiplied 10 000 by 2.
In (b)(i) a pleasing number of candidates correctly stated what is meant by an isotope although a few either contradicted themselves or mixed up protons and neutrons.
In (b)(ii) a surprising number of candidates were unable to state 'background'.
In (c) few candidates were only able to state one correct non-medical use of radioactivity often giving medical uses or those associated with nuclear weapons or energy.

Question 5
The calculation was well done in part (a) but candidates were often confused by part (b) where the given transformer had to be used as a step-down rather than a step-up. Instead of reversing input and output many candidates suggested adding more turns to the primary. Some candidates suggested reversing the current.
In part (c) some good answers were seen which often quoted the value of 240 V although answers like 'it is too high' were often seen. In part (d), the reason why the voltage is increased just outside the power station was well known.

Question 6
Part (a)(i) was well answered with opposite charges attracting but in (ii) many candidates stated that the frame was now neutral rather than like charges repel.
Both answers were occasionally given in terms of poles rather than charges.
In (b) candidates were only expected to state that the back of the frame was negative though in (c) most were able to suggest that walls should also be positively charged or covered up.
Most candidates were able to give the expected answers for two uses of electrostatic charges. A mark was allowed for any phenomenon observed in the classroom such as balloons sticking to walls or use of the Van de Graaff generator. Some candidates gave two such examples but only one mark was awarded.

Question 7
Parts (a) and (b) were well answered in terms of movement of particles in the solid and liquid states. However part (c) was often answered in terms of particle movement rather than arrangement which was required.
Nearly all candidates in part (d) could name a process by which a liquid changes to a gas.

Question 8
In part (a) most candidates knew what was meant by a vector quantity and in (b) the correct answer showing the difference between X and Y was almost always seen unless X and Y were added.
Part (c) was answered well with candidates pointing out that acceleration is a vector but a significant number agreed with the student that all the quantities were scalars. A mark was deducted if another quantity in addition to acceleration was thought to be a vector.

Question 9
In part (a) many incorrect answers such as 'strong' and 'equal' were seen but in (b) nearly all could identify the poles at X and Y.
In (c) completely correct answers were rarely seen with answers, such as 'magnetic' and 'moving' in the first gap. A frequent incorrect answer in the second gap was 'proportional'.

Question 10
Although most responses in (a)(i) were correct, a common error was to write the relationship as density = pressure x height x *g*. Some omitted the acceleration due to gravity.
The calculation in (ii) was usually correct and the unit for pressure was well known.
The direction of the pressure acting was usually given as 'downwards'. In (b) 'gravity' rather than 'weight of air' was given for the cause of pressure exerted on everyone on Earth.

Question 11
In part (a) most candidates could identify component X as a variable resistor. In (b) completing the sentence 'current is the flow of charge' for one mark was incorrectly done with 'amount' or 'speed' instead of 'flow'.
In (c) many candidates ignored the request for units for the quantities to be written in full. Instead the abbreviations C, A and s were given often interspersed with Ω.
In (d)(i) the electron was well known but in (ii) the flow was described rather than explained with answers such as 'they go clockwise' or 'they flow from negative to positive'.

Question 12
Most candidates were able to state the equation for acceleration in part (a)(i) and calculate it in (ii). The majority converted to seconds and scored 3 marks. A small number of candidates used '50' in their calculation.
The motion in the section MN was described accurately but in part (b) only a minority of candidates gave the correct unit in (d) with most answering 'metres'.

Question 13
Part (a) was very well answered. In (a)(i) some answers only referred to one of the forces while in (ii) 'upthrust' was frequently seen with 'gravity' less frequently seen. In (iii) nearly all candidates knew that the friction force increased although in (iv) not all knew the term terminal speed (or velocity).
Part (b) was well answered with many candidates scoring full marks. The remainder either used the wrong equation for kinetic energy, transposed the equation incorrectly or forgot to take the square root of v^2. The correct unit was usually seen.

Question 14
In part (c) the unit kPa was well known with a variety of acceptable spellings seen. The most common wrong answer was 'pressure'.

Question 15
In part (a) the formula and calculation were frequently correct. The main cause of error was missing out multiplication by 10 for *g* which was reflected in the formula. The answer to a(iii) was often not the same as in a(ii). In some cases the equation for kinetic energy had been used. A few may have thought of the formula for kinetic energy and then decided to halve the value from (ii).
Few candidates scored well in part (b) where often 'large force' and 'quickly stopping' from the stem were repeated without giving an explanation. A common misconception was that the force acting on the pile was equal to the kinetic energy of the falling mass.
Many got the idea of the deceleration being large and more used $F = ma$ in their answer somewhere but very few mentioned a short stopping time.
Most candidates tried to explain in terms of deceleration rather than energy transfer but the latter rarely mentioned was $W = Fd$ in their answer.
The usual answer to (b)(ii) was 'downwards'.

Question 16
Parts (a) and (b) were well answered with '275' occasionally being used instead of '273'.
In part (c) candidates often gave incomplete answers stating that the average kinetic energy merely increased rather than doubled when the kelvin temperature was doubled.

Question 17

The majority of candidates scored the mark in (a) but a wide variety of wrong answers was seen such as 'current' and 'force field'.

Part (b) was answered well although some examples of right hand and grip rules were seen. The left hand rule was attributed to many scientists including Ian Fleming.

Many candidates got most marks from their diagrams although some diagrams were very poor and it was not possible to tell which finger was meant to represent what. Some candidates stated that the first finger was (magnetic) 'force' with the thumb being termed 'movement'

Better diagrams were labelled twice, with "first finger" and "field", rather than just "field".

The most common errors were omissions of the direction of either current or field or confusing them (e.g. current goes from north to south).

In part (c) some candidates confused the effect with electromagnetic induction by stating 'move the magnet faster'.

Question 18

In part (a) a large number of candidates either left this blank or showed an incorrect angle of refraction.

In part (b) candidates often did not refer to the 'angle' of incidence in their statement or gave a correct answer apart from using 'reflection' rather than 'refraction'.

In part (c) the equation relating refractive index and critical angle often lacked 'sine' or was the correct one that related n, i and r.

In part (d) candidates were familiar with total internal reflection.

In part (e) between two and four reflections scored the marks.

Common errors were: the angle between the incident and reflected rays was a right angle, more than four reflections were shown and the ray was not continued from the provided ray to the wall of the fibre.

Question 19

Part (a) was well answered with a lot of crossing out and drawing lines around the back of boxes in evidence.

In part (b) the symbol for the alpha particle was well known.

Problems in (c)(i) stemmed from the subscript for e being given as +1. Candidates still went on to refer to beta radiation and the emitted electron in (ii). A few candidates identified the radiation as alpha or gamma but still earned a mark for the emitted electron.

4420 Physics Paper 03

The examiners were pleased to note the very high quality of the work from many candidates.

Question 1

1(a)(i) Most gave the correct answer though a significant proportion gave 72 seconds.

1(a)(ii)1 The majority realised that the speed is getting faster though a small minority did not grasp the idea of a trend and simply noted that it is small.

1(a)(ii)2 Some missed the idea that the student is not reacting to an external stimulus.

1(b) Most gained all three marks. Some of those who got it wrong lost the opportunity to gain some credit because no working was shown.

1(c)(i) Almost all were able to count and record the number of spaces.

1(c)(ii) A majority got the correct answer although a significant minority used the number of dots rather than the number of spaces, even when they had got the first part correct.

1(c)(iii) Most were able to calculate the period of time correctly.

1(c)(iv) A majority gained this mark but the scale on the horizontal axis defeated many less able candidates. Some failed to record their distance from part (b) and then could not be given credit for correctly reading the time if their answer to (b) was wrong.

Question 2

2(a)(i) Almost all gave the correct reading to the nearest gram.

2(a)(ii) The more able candidates noted that it is almost impossible to apply the same force in both cases and that the top pan balance displays mass rather than force. However some candidates had difficulty in expressing their ideas and a fairly common incorrect idea was that the top of a top pan balance does not move when a force acts on it. Some claimed that different forces are needed or confused themselves by noting the differences in area.

2(b)(i) The majority measured the key correctly and calculated the area. Despite the question stating that the key is square, some candidates gave different measurements for the sides.

2(b)(ii) Most candidates calculated the pressure correctly and usually gave the result to 2 or 3 significant figures. However a minority ignored the force given in the stem of 2(b) and used the mass from 2(a).

2(b)(iii) Examiners were pleased to note that there appears to have been a significant improvement in most candidates' understanding of this concept even though it was clear that some candidates did not understand the difference between significant figures and decimal places. It was fairly common for these candidates to give 0.29 in part (b)(ii) and then to state that this is to 3 significant figures. Confident candidates correctly explained that they had used 2 significant figures because this is the same as the original data.

Question 3

3(a) Almost all gave the correct measurement to the nearest tenth of a centimetre or measured the separation as 36 mm.

3(b) Most correctly found the average value for the background radiation in (i) and could identify the anomalous result in (ii). However they failed to attach any significance to their possible connection. The most popular suggestion was that the anomalous result was caused by having the source nearby and only a minority correctly suggested that the count had been made for two minutes.

3(c)(i) Most correctly interpreted the graph and either expressed the range of these alpha particles as 6 cm or as 0-6 cm.

3(c)(ii) Too many candidates started by making irrelevant points about setting up apparatus which is already set up. A number attempted to describe the workings of a GM tube or Rutherford scattering. This often meant that a candidate had filled half the available lines before writing anything which would gain a mark. Too many failed to consider background radiation or failed to mention an appropriate safety precaution.

3(d)(i) The majority identified the use of tweezers as a sensible safety precaution though a minority often chose a lead screen.

3(d)(ii) Some candidates had difficulty in expressing their ideas clearly but, since many had already indicated the appropriate choice in part (i), most were able to secure two marks from the three marking points available to them.

Question 4

4(a) Many drew a correct circuit diagram with a power source, a rheostat and an ammeter in series. However some omitted one of these three essentials so no marks were available to them. Others included another resistor, such as a lamp, rather spoiling the point of the planned investigation and losing their second mark.

4(b)(i) Candidates who omitted an ammeter or cell from their circuit often added it here but gained no credit.

4(b)(ii) Many candidates failed to express their ideas clearly. Most scored two marks out of the three available; for setting distance L and measuring the current, moving the slider and noting the new length and current and for at least one more pair of measurements.

4(c) Nearly all correctly read the diagram of the meter.

4(d)(i) Full marks for the table were fairly common but less able candidates often failed to include the correct units, or to place the results in order or, occasionally, failed to transcribe all the readings correctly.

4(d)(ii)–(iv) Most scored well on this graph. Marks were sometimes lost if the axes were not correctly labelled. The scales created problems for some who failed to interpret them correctly and who then lost two marks for their points. However it was rare for candidates to fail to identify the anomalous point and most managed a well drawn curve of best fit for their remaining points.

4(d)(v) Only a minority realise that the most likely suggestion is that distance L has been read from the wrong end, or the wrong side, of the rheostat. Most contented themselves, but not their examiners, with a comment about misreading or faulty apparatus.

4(e) A majority used their subject knowledge or interpretation of the data to conclude that the current would be high but many incorrectly stated that the problem would be that the slider would be too wide to move to 2 cm or that this distance is too small to measure.

4420 Physics Paper 04 (Coursework)

The total number of centres entering candidates for this component of the examination increased again this year.

The moderating instrument used was the Sc1 criteria previously used by home centres, using exemplars provided by the JCQ (Joint Council for Qualifications) as a guide.

Generally the work seen was of grade C or higher standard, with very few grade G candidates. The marks awarded by the centres for investigations for the separate sciences tended to be high and a number of full marks were seen in the samples and the average mark for the centres' assessments was in the mid twenties. In fact the lowest mark for a number of centres was in the low twenties.

Skill Area P: Planning

Comprehensive and detailed scientific information was often written but it was not always used sufficiently to support predictions and inform plans. Candidates did not always consider the control and monitoring of all relevant factors when they were planning how to obtain reliable evidence as often no plan was made to control or monitor the ambient temperature during the course of the investigation even though candidates had stated it was a variable to consider. As a consequence, it was not always possible to support the award of P.8a. Most candidates carried out some form of preliminary work involving the establishment of the range to be investigated, but on occasions some other factor was investigated, such as a suitable time duration for the osmosis activity. Candidates did not always appreciate that in order to satisfy P.8b they should show how this preliminary work informed the main investigation that they were going to perform.

Skill Area O: Obtaining Evidence

Many of the centres and their candidates failed to recognise that taking averages of results where there are significant variations, does not give reliable evidence. Very rarely did candidates identify these anomalies and then repeat the measurements so that they could ignore rogue results when calculating averages. Occasionally candidates averaged the readings for individual components such as voltage and current for a particular length before carrying out a calculation to determine the variable linked to the investigation (i.e. resistance) and, if the values of the item being averaged showed significant variations, then the reliability of the evidence was compromised. Some candidates did not appreciate the need to control and monitor significant variables. The obvious one being the ambient temperature at which the investigation was carried out. For these reasons, rarely was it possible to support the centre's award of eight marks for this Skill Area. However, most candidates were able to justify the award of at least six marks by the systematic and accurate means they had collected and presented their evidence.

Skill Area A: Analysing and Considering Evidence

Most candidates were able to carry out the required calculation for the factor under investigation, i.e. percentage change in mass of potato stick, rate of chemical reaction and resistance of a wire, and then use this information to draw the graph of the evidence, with a line of best fit in the form of the expected straight or curved line, thus achieving A.6a. Detailed scientific knowledge was often used to discuss the evidence to produce a valid conclusion, but this evidence was not always the processed evidence shown by the graph. Sometimes the data in the table of results made the award of A.8a problematical. It was good to see discussions that often considered the shape or angle of the graph in order to determine the exact relationship between the variables investigated. Candidates still find it difficult to discuss the prediction in terms of the processed evidence displayed in the graph and often ignored the tentative nature of any relationship displayed by the scattering of plotted points around the line of best fit, making the award of A.8b difficult to justify.

Skill Area E: Evaluating

Most candidates were able to identify anomalous results and make some comment on the quality of the evidence obtained and so satisfy E.4a. Discussion of the procedure and identification of possible improvements was surprisingly weak in some cases, although E.4b had usually been awarded. Most candidates understood that any further work suggested had to be described in some detail and justified in terms of the original task, either by extending the range investigated or by investigating a linked factor for E.6b to be awarded. However, discussion of the reliability of the evidence obtained and, in particular, explaining the cause of identified anomalies, was not always easily accomplished, yet E.6a seemed to be freely awarded in a number of cases.

At most centres there was clear evidence that internal standardisation had been scrupulously carried out, and there appeared to be consistency in assessment across the various groups in a large entry. The marks were always confined to a single investigation for the separate sciences (two could have been used) and mainly just two for the Double Award Science entries when a maximum of four investigations is possible.

Physics 4420

A range of tasks was seen this year. The most common was resistance in wires. This was the most common Physics task seen in UK centres, and it can achieve the full range of marks. Most candidates had investigated the resistance of different lengths of wire, although the effect of cross-sectional area of wire on resistance was also seen. A few insulation of materials investigations were also seen this year..

Some other tasks seen this year included parachutes, balls rolling down ramps, and bouncing balls.

Centres are reminded that to fully achieve P8b, candidates need to clearly show how the preliminary work has affected their planning for the main task. It is not necessary to carry out the entire task as a trial run – only two values of the range chosen (normally the extremes of the range) are required, in order to see if the range chosen is appropriate. The moderators were pleased to see some sensible and appropriate preliminary work being carried out which aided the planning of the main investigation and was usually correctly given credit by the award of P.8b.

When awarding A6b, teachers need to bear in mind that the specification requirements are that the candidates should explain the science behind the results they have obtained. Merely describing the shape of the graph does not result in the student achieving A6b.

For E4b, candidates are required to suggest at least one meaningful improvement to the technique used – and give some indication as to why the improvement(s) proposed would result in the obtaining of more accurate data.

It was very rare to see 6 marks awarded in skill E, mainly because candidates were generally unable to discuss the reliability of the evidence, although they could usually come up with an explanation for anomalies in their evidence (E.6a).
Some good suggestions for further work to provide additional relevant evidence with good descriptions were seen (E.6b), but there were still examples of candidates being given credit for simple statements of what they might do next, which is not worthy of full marks

PHYSICS 4420, GRADE BOUNDARIES

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

	A*	A	B	C	D	E	F	G
Foundation Tier				64	51	38	25	12
Higher Tier	79	67	55	43	32	26		

Option 2: with Coursework (Paper 04)

	A*	A	B	C	D	E	F	G
Foundation Tier				68	54	40	26	12
Higher Tier	82	70	58	47	35	29		

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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