IGCSE PHYSICS 4420, NOVEMBER 2005
CHIEF EXAMINER'S REPORT

Paper 1F

General comments
Questions 1 to 8 were targeted at Grade F candidates. Except for question 9, these questions scored higher than the remaining questions which were targeted at grade C candidates. Entries for this first November session were very small and the comments which follow are based on only a small number of scripts.

Judging from a very small entry it appeared that candidates had been entered for the correct tier.

Question 1
Parts (a) and (b) were answered well although few candidates knew that the force between two charged insulators is electrostatic. Part (c) was poorly answered. Candidates were asked to select factors that may reduce stopping distance. From a list of six possibilities, candidates were more inclined to pick, for example, large mass of lorry rather than small mass of lorry, showing a misinterpretation of the question rather than lack of knowledge. In (d) candidates showed an inability to interpret the features of a distance-time graph.

Question 2
This was one of the best-answered questions on the paper. Candidates knew the order of colours in the visible spectrum and the order of the parts of the electromagnetic spectrum. They knew the order of increasing frequency and uses for microwaves. Some candidates lost a single mark for stating that a high dose of infra-red would damage the skin by causing cancer rather than burns.

Question 3
Most candidates could identify a fuse and knew the dangers of pushing a plug into a socket with wet hands. Filling the gap in (b) provided voltage as an answer rather than current. Nearly all candidates failed to score the final 3 marks for interpreting a double-insulation situation.

Question 4
Candidates often did not distinguish between forces and energy and some careless answers here and in Question 1(b) cost unnecessary marks.

Question 5
As in May 2005, some candidates were unaware of the options available when naming an energy transfer process. In (a)(ii) many candidates knew that when air is heated its density gets less but failed to explain how an extra blanket on a bed reduces heat transfer from the human body. From the following three points in the mark scheme :

- made of wool/ material which is an insulator
- traps/holds air
- (still air) is a good insulator

only the first mark was occasionally scored.

Question 6
A surprising number of candidates could neither name the processes of melting or boiling/evaporation when prompted, nor knew that the separation of molecules in a liquid is similar to that in solids. In (c) an explanation of gas pressure should have referred to molecules hitting the sides of the container but instead concentrated on collisions between gas molecules.

Question 7
Most candidates knew which materials from a list could be attracted to a magnet and have magnetism induced. There were no successful answers to (c) where candidates were asked to identify two magnets from three metal bars. The occurrence of repulsion was not mentioned in any answers.

Question 8
This question was well answered although few knew that 'photographic film' in the list could be used for detecting ionising radiations. Part (b) for a total of six marks was very well answered with candidates picking items from a list.

Question 9
This was the best-answered question on the paper where candidates needed to know that sound waves are longitudinal. This was the first calculation on the paper and was well answered. The limits of the audible range were well known.

Question 10
All candidates knew that the cloth was an insulator but thought that the rod was a conductor. They could not explain (b) but knew that a positive ball moves towards a negatively-charged rod. The explanation needs to be more definite using 'unlike charges attract' rather than 'different charges attract'.

Question 11
Plotting of points, drawing a line and getting information from the line was very well done. Given a force-extension graph, few candidates were able to tell whether it was that of a metal wire, helical spring or rubber band or give reasons for their choice.

Question 12
Very few marks were scored on by far the worst-answered question on the paper. This topic is not well understood.
Candidates were given three situations involving an electric current :

1. current in a straight line
2. current in a flat circular coil
3. current in a solenoid.

They were given four field patterns and asked to link each situation to its matching pattern. Most linked 1 to a pattern of three straight lines and 2 to a pair of concentric circles. The idea that a magnetic force does not act on a charged particle when it travels parallel to the field was also not known.

Question 13
The conversion of light energy to electrical energy in a solar cell was quite well known but not the need to convert from minutes to seconds when calculating rate of transfer of energy, in watts, from a known energy input.
Reasons for changes during the day were often known although the same reason was sometimes given twice; for example, 'the Sun's position changes during the day' and 'the Sun is weaker in the early morning'.

Question 14
None of the candidates were able to draw lines to show the formation of an image by a mirror.

Question 15
Most candidates scored at least one out of two for differences between a dry cell and the mains. The drawing of two lamps in parallel to be switched off independently was disappointing.

Question 16
Most candidates performed the calculations very well despite working with difficult numbers. With values for volume, mass and density most were able to recognise which of two materials was the least dense and had the least mass. Unfortunately the means of determining volume was given as manipulation of the density formula rather than using measurements of the dimensions and multiplication. Unfortunately candidates presented the data already given in the question.

Paper 2H

General comments
The majority of candidates had been correctly entered for this tier and their responses were generally good. In particular, the general ability of candidates in the mathematical parts of questions was commendable. Questions 1 to 8 were common to this paper and the Foundation Tier paper. Questions 9 to 18 were generally more difficult and some of their content was from the 'Higher Tier only' parts of the specification.

Question 1
This question was very well answered with most candidates gaining full marks.

Question 2
In (a), a significant minority asserted that one was a conductor and the other an insulator. Better candidates gave a correct explanation in terms of electrons in (b), and in (c)(i) and (ii) nearly everyone gained both marks.

Question 3
In (a), most candidates plotted all the points correctly but the point 3.5, 9.5 was the one that some found difficult. Credit was given for a line of best fit for the candidate's points but some did not seem to appreciate that it cannot be correct if the points that are not on the line are all on the same side. In (b), nearly all could correctly read their graph. In (c), many were able to state that the elastic limit would probably have been exceeded or that the graph would probably not be linear for very large loads. Most candidates offered a correct response to (d)(i) but then often guessed at an incorrect answer to (d)(ii) such as 'the rubber band would snap'.

Question 4
In general the responses to this question were very poor. In (a), many linked the concentric circles with the circular coil and the parallel lines with the straight wire. In (b), very few appreciated that the force will be zero because the particle will not 'cut' the magnetic field lines.

Question 5
This question was generally well answered although, in (a), some seemed to have confused solar panels (which transfer infra-red radiation to heat) with solar cells (which transfer light energy to electrical energy). In (b)(ii) examiners gave credit to candidates who referred to the Sun 'moving', because the intention was clear, but were more pleased to read that the Sun **appears** to move.

Question 6
That the angle of incidence equals the angle of reflection was very well known. However in (b) most could only manage one mark by completing the reflected ray for the given incident ray, but failed to repeat this for another point on the mirror and then to show the back projection to the tip of the kitten's tail. Some erroneously thought that a line from an eye of the real kitten to the tip of the virtual kitten's tail would gain some credit.

Question 7
In (a) most candidates were able to offer at least one difference. In (b), most had the two lamps in parallel but a significant proportion failed to have a switch in series with each of them.

Question 8
This question was well answered with nearly all candidates securing full marks in parts (a)(i),(ii) and (iii). In (b), full marks were often obtained either by the measurement method or the displacement method. However, the examiners did not consider that rearranging the equation was appropriate in this case.

Question 9
Well answered by nearly all candidates. The most common mistake was to lose a mark by failing to give the direction in (b), even though the question reminded candidates that this was required.

Question 10
This was quite well answered but in (b) some just wrote 'frequency' (or 'wavelength') and 'amplitude' rather than 'reduce frequency' (or 'increase wavelength') and 'increase amplitude'. In (d), the most common mistakes were to confuse the distance and twice the distance and to make impractical suggestions such as that one person could 'hit the bricks together and start the stopwatch at the same time'.

Question 11
Parts (a) and (b) were well answered. In (c)(i), some decided that the torch bulb had become a lamp connected to the mains and some did not refer to electrons in their answers. In part (ii) a common error was to explain the relationship between resistance and current rather than to answer the question and state the effect of the current in the filament and explain it.

Question 12
This question was well answered. In (b) there are a variety of possible correct responses, of which the most popular pair were that the rock had 4375 J of gravitational potential energy to start with on the assumption that there was no air resistance.

Question 13
This question was well answered. Commonly made points were that wind turbines use a renewable energy resource, that there is no pollution created in their use and that the wind is not reliable.

Question 14
In (a)(i) a majority realised that the temperature needs to be constant but few could offer a second correct point, namely that the mass remains constant or that the gas remains an 'ideal' gas. In (b) some gained credit in (ii), even when they had (i) wrong, by suggesting, for example, '546 K'. Nearly all obtained at least one mark in (c), usually for stating that the (average) speed of the particles would increase.

Question 15
Nearly all achieved one mark in (a)(i) but some did not make the distinction that step-up transformers are used at the generation end of the power lines and step-down transformers at the distribution end. In (a)(ii) many knew that a high voltage is used for transmission in order that the low current will result in lower energy losses. However, few explained that finally the voltage needs to be reduced because this is safer. Part (b) was generally correctly answered.

Question 16
In (a), although about half realised that the wire needs to be insulated in order to prevent shorting, many others suggested that heat insulation or prevention of electric shock is the reason. In (b)(i) many answers appeared to be guesses at the direction of movement but nearly all candidates gained both marks in (b)(ii). In part (c) many were confident enough to correctly offer 3.6 but some thought that 1000 must somehow be involved. Most achieved a mark in (c)(ii), although this was partly because the examiners allowed answers which were clear even though misspelled.

Question 17
Parts (a),(b) and (c) were well answered in general, but a common mistake was to offer 'heat' rather that 'kinetic' as the energy in (c). In (b) the examiners were looking for an answer along the lines of 'neutrons hit other nuclei which release more neutrons which hit other nuclei, and so on'. The alternative for the second mark was a correct reference to critical mass, but nobody offered this.

Question 18
Although candidates did not appear to lack time to read this question carefully and to give thought to what they were required to do, very few got close to full marks. In (a), although some had a horizontal line corresponding to the maximum value for the speed downwards, few extended this to the y-axis and then marked the intersection as the value for the terminal velocity. In (b) the obvious feature of the graph is that the slope of the line changes, and yet most attempted to 'explain the shape of the graph' without any reference to the slope. A common misconception was that the stone 'slows down', whereas it speeds up, at a slower and slower rate, until it reaches its terminal velocity. Many realised that the change was connected with air resistance but few clearly stated that, as the speed increases, so does the air resistance.

Paper 3

General Comments
Several areas of this paper were dealt with very competently. Graph work, calculations and observations scored well but, with very few exceptions, descriptive work scored below the potential of the candidates concerned.

Question 1
In (a) most candidates scored the mark for reading the scale of a newtonmeter. Surprisingly many answers read to two decimal places which the precision of the diagram did not justify. The mark in (b) was scored by all candidates where they had to deal with the zero error of the instrument.
In (c) candidates had to describe how to use a newtonmeter to measure the force needed to open a door. Given a plan view of the door the mark scheme was :

- attach newtonmeter to door handle
- hold other end of newtonmeter
- pull door open and read newtonmeter.

Candidates often wrongly involved the mass, from the diagram on page 2, in their description and most scored no more than one mark in this section. Practically all candidates were aware that more force was needed if the newtonmeter was attached to a hook halfway between the handle and the hinge.

Question 2
Accurate measurements were taken from a diagram of a manometer. A conversion from mm to m before calculating pressure difference using a height difference was rarely done but cost only one mark. Some very good answers to (c) were seen, where a height difference using only one level had to be measured and doubled.

Question 3
Most candidates were able to connect an ammeter and a switch into a circuit but the voltmeter proved to be more problematic, usually appearing in series with the other components. Observations of ammeter and voltmeter readings scored well. The graph in (c) was well plotted but occasionally the line was forced through the origin. Units were occasionally missing from the graph labels. In (d)(ii) a few candidates gave a correct suggestion for the anomalous result on the graph.
In (e), measurements of the length of a conducting material between two crocodile clips was usually within a generous allowed range. In (e)(ii) some candidates had an idea as to why the graph did not go through the origin but they expressed themselves poorly.
In (f) a few candidates could interpret the graph given as measuring the whole length of the conducting material but forgot to say that this was done for each value of R.

Question 4
The observations in (a)(i) scored well, where a ball-bearing was released on a slope and ran up a ramp before being projected at an angle into a sand pit. A description of the procedure in (b) was disappointingly answered. The mark scheme was 7 from the following 8 points for the main planning task on the paper.

1. Use the protractor (to measure the angle)
2. Place the ball-bearing on the slope and release
3. Note the position in the sand
4. Use a rule (to measure distance from this position to the bottom of the ramp)
5. Smooth the sand

6. Repeat the reading
7. Find the average value
8. Change angle and repeat experiment

Points 2, 3, 5, 6, 7 and 8 were rarely scored.

Part (c) was well answered. Candidates had to judge the angle for the greatest range from the points on a graph that had not been joined up. They then had to suggest why results for two extreme angles would be unsatisfactory.
Part (d) asked what was to be kept constant. Few stated the initial position of the ball-bearing on the slope.
Part (e) referred to the measurement of height. Some mentioned the use of a rule, but with no reference to it being vertical with the zero on the sand surface. There was no mention of measuring to the bottom of the ball. Quite a few used video cameras, but if an answer is to feature technology, candidates will be prompted in that direction.

PHYSICS 4420, GRADE BOUNDARIES

Grade	A*	A	B	C	D	E	F	G
Option 1				59	48	37	27	17
Option 2				60	49	38	28	18
Option 3	80	70	58	46	34	28		
Options 4 + 6	81	71	59	47	35	29		

Option 1: Papers 03 / 1F
Option 2: Papers 04 / 1F
Option 3: Papers 03 / 2H
Option 4: Papers 04 / 2H
Option 6: Papers 04T / 2H

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