edexcel
advancing learning, changing lives

Examiners' Report Summer 2008

IGCSE

IGCSE Physics (4420)

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information please call our Customer Services on + 44 1204 770 696, or visit our website at www.edexcel-international.org.uk.

Summer 2008

Publications Code UG020271

Contents

4420 Physics Paper 1F

Examiners were pleased to note the high quality of some of the work.

Question 1

1ai, ii and iii Nearly all candidates were able to interpret the distance-time graph correctly.

1bi and bii Nearly all were able to complete the explanations correctly.

1c Some did not express themselves clearly and/or they confused distance and time taken in their answers. Good answers compared the appropriate intervals on the y-axis.

Question 2

2ai and ii Most chose correct words from the box. Full credit was given for either order.

2b Some had difficulty in expressing the idea that stray wires were the fault.

2ci and ii Most recognised that the plastic covering made it unnecessary for the small radio to be fitted with an earth wire and that the fuse is unlikely to blow because the current is only low.

2d The most popular correct suggestion was to use a circuit breaker or to have double insulation.

Question 3

3a Most knew that waves transfer energy but fewer knew that they also transmit information.

3b Most had the general idea correct but some chose A rather than D and/or chose B, or more commonly E, rather than C.

3ci and ii Many were uncertain about how to describe frequency and did not seem to realise that part ii was asking about the wave equation.

3di Most knew that waves which are not transverse waves are longitudinal waves.

3dii and iii Most recognised 20 Hz -20 000 Hz as the correct range of frequencies and nearly all knew the range for an elderly person is less than that for a teenager.

Question 4

4ai	Most recognised that this must be a microphone.
4aii	Nearly all were able to name an appropriate device such as an electric kettle.
4b	Rather surprisingly this was less well answered with a significant minority incorrectly suggesting devices, such as a swing, where the transfer is from KE to GPE as well as from GPE to KE.
4c	Most were able to give either heat or sound as their answer.
4d and e	Only a minority were are to make the correct selection and/or knew that 'kinetic' correctly completes both boxes in part e.

Question 5

5ai and ii	In part i, only a minority realised that this must be 100 000 and, because most did not realise that the unit refers to an average decay rate of one per second, very few could complete part ii.
5bi	A significant minority was able to calculate the counts per minute as 330.
5bii and iii	Only a minority realised that the reading was due only to background radiation and even fewer described it as variable.
5c	There was a wide variety of correct responses.

Question 6

6a	Nearly all had yellow and green in their correct order.
6bi and ii	When infra-red and ultra violet were given, they were almost always the correct way round and ultra violet was given as the part with the higher frequency.

Question 7

7ai and ii	Only a minority offered 'continually' or 'continuously' to complete the sentence though many had 1 and 0 or on and off or high and low in part ii.
7b	Most were awarded all three marks.
7c	Most were able to secure a mark, 'better quality' was a popular response, but some incorrectly suggested that digital signals are faster or stronger than analogue signals.

Question 8

8a	Nearly all were able to complete the sentence either with the term boiling or evaporation.
8b	Good answers showed just four particles, all the same size as in the previous diagram but nearer to each other and with each in a random direction. However, in many answers, one or more of these features were fairly often absent.

Question 9

9ai and ii Both were usually correct.

9aiii Full credit was given for a response in the style of the printed example or for two separate lines each correctly labelled drinking (alcohol) and slippery (road).

9bi A variety of responses were credited. However, examiners were disappointed that that more did not offer 'air resistance'.

9bii Examiners were disappointed that only a minority seemed to understand that, if X is the centre of mass of the car, then its weight must act vertically downwards from this point.

Question 10

10ai and ii Most gave correct responses to both parts.

10bi and ii Many correct responses to both parts.

10biii Many muddled responses indicating poor understanding. Very few candidates were confident that, in a transverse wave, each point on the wave is moving at 90° to the direction in which the energy of the wave is moving.

Question 11

11ai Some did not seem to understand that 'voltage = current × resistance' is a perfectly correct response to this question and muddled themselves by attempting a transposed version in terms of current.

11aii However, many corrected themselves in this part though some omitted the unit.

11b 'decrease' followed by 'increase' gained two marks but (1) mark was awarded for 'increase' and then the consequentially correct 'decrease'.

Question 12

12ai Many correctly identified the component as a diode but light-emitting diode or LED was not acceptable.

12aii Only a minority offered 50 (mA) in both cases. 25 (mA) and 25 (mA) was a popular incorrect pair.

12aiii Only a minority noticed that one cell in the battery is connected the wrong way round or wrote that some of the voltage is across one, or more, of the other components.

12b Many offered a description of the shape of the curve rather than an explanation. Only a very small minority even mentioned temperature and consequently an appropriate response, for example, 'as the voltage across the filament increases the filament's temperature increases, therefore its resistance increases and the curve becomes less steep' was hardly ever seen.

Question 13

13ai Many correctly stated that, at absolute zero, molecules do make any kind of movement.

13aii and iii Many remembered that absolute zero is -273 °C and were able to calculate that 100 °C is 373 K.

13b A minority were able to offer a modern explanation but some just copied parts of the passage.

Examiners were looking for responses of this sort,

'Larger particles are knocked about by the random motion of tiny, invisibles molecules'.

Question 14

14ai Candidates needed to give 'electrons' in both parts to get the mark.

14aii and iii Though some stated that polythene is an insulator few gained the second mark by mentioning that it is slow to discharge and, though some mentioned that copper is a conductor, very few gave the alternative explanation that the rod is earthed.

14b Nearly all suggested that a spark could ignite the petrol vapour and cause an explosion.

Question 15

15a Some did not give a clear indication on their graph that a suitable time interval had been chosen. Another mistake was to fail to convert the time interval from hours to minutes.

15b Marks were given for any two points from the following three

- tracer taken in (it can be swallowed/injected/ingested)
- (gamma) radiation emitted
- progress can be followed (by a detector)

and most candidates gained some credit.

Question 16

16a Most candidates did not know that voltage is induced across a copper coil when a magnetic field changes through the coil.

16b Many could not correctly complete the transformer equation with

$$\frac{\text{number of turns on the primary coil}}{\text{number of turns on the secondary coil}}$$ or its equivalent.

16ci and ii Most completed both parts correctly.

4420 Physics Paper 2H

General

With a greatly increased entry some truly outstanding work was seen.

Question 1

This question was very well answered. In (a)(i)(ii) candidates read the times correctly from the graph. In (a)(iii) most candidates drew two graphs to show the two effects separately of the driver drinking and the road being slippery. If they chose to do this rather than just show one graph consisting of two lines then the marks could only be scored if the separate graphs were suitably labelled.

In (b)(i) a wide range of factors were credited as affecting the force of friction on the car. Unfortunately a significant number of candidates responded with 'condition of tyres' and 'condition of road surface'.

In (b)(ii) a significant minority of candidates showed the arrow indicating the weight of the car coming downwards from the centre of the car instead of from its centre of gravity.

Question 2

In (a) candidates showed good recall of the use of parts of the electromagnetic spectrum but were less sure in (b)(i) and (ii) about the property shared by these waves and an example of another transverse wave. Although many candidates scored this mark by referring to water waves many more stated sound waves.

In (b)(iii) candidates were not often able to correctly fill the gaps describing the nature of transverse waves. The second gap was often 'direction'.

Question 3

This question was very well answered. In (a) the vast majority of candidates were able to state the equation and calculate voltage giving its unit from given values of current and resistance. In (b) most candidates were familiar with the behaviour of a light dependent resistor when moved to a lighter position although a significant number scored just one mark for getting the effect the 'wrong way round'.

Question 4

This question was not well answered. In (a)(i) a significant number of candidates were unable to recognise a diode from its circuit symbol with many considering it to be a resistor. A common wrong answer to (a)(ii) was to give both ammeter readings as 25 mA. In (a)(iii) the main reasons given were that the diode was connected the wrong way round, the cells had run down or the switch was open. Where candidates noticed that the cells were incorrectly connected they often commented in a clumsy manner usually referring to batteries rather than cells.

In (b) some excellent answers were seen but these were in the minority. Asked to explain the shape of the voltage –current graph for a filament lamp many noted that it was non-ohmic or the increase was not proportional. Often candidates wrongly referred to a decrease in current or spoilt a promising answer by stating that the resistance decreases.

Question 5

The second part of this question was not well answered.

In (a)(i) most candidates stated categorically that there was no molecular motion at absolute zero. Some did not score this mark because they had presented theories that go beyond the level examined or because of contradictory statements like: 'they are motionless but still vibrate a little'.

In (a)(i) most candidates dealt competently with the Kelvin and Celsius temperature scales.

In (b) a few candidates based their explanation of Brownian motion on diffusion without considering collisions. The difficulty that candidates faced was that given a long passage in the stem they were unlikely to score marks by repeating phrases from the passage. Terms like 'random' and erratic' were therefore best left out of the response.

The marking points were

- particles collide
- with smaller or different named particles
- causing a change of direction

with the second and third marks being dependent on the first.

Commonly seen was : 'particles collide and move randomly'.

Question 6

In (a) most candidates were not put off by the fact that both answers were the same although a few 'negative ions' and 'negative charges' were seen.

The explanations in (ii) and (iii) often skirted around the answer when it was suspected that the candidate could have gained full marks. Again in (ii) it was advisable to avoid the wording in the question when responding. A lot of responses said that the negative charges remained. More candidates pointed out that copper is a conductor rather than polythene is an insulator.

In (b) most candidates came up with 'spark'.

Question 7

This question was well answered. In particular very few errors were seen in (a) where the graph was used to find the half-life in hours and then convert into minutes, Candidates over a wide range of abilities scored the full three marks here.

In (b) most candidates knew that the radioactive isotope had to be taken into the body and followed up by the need to detect it from outside the body.

Question 8

Very few candidates were able to fill in the gaps in (a) to complete a statement about electromagnetic induction. Unless both answers were given correctly they were unlikely to score.

By contrast candidates showed a good knowledge of the remainder of the question.

In (b) a number of correct expressions were given for the equation for a transformer including some involving current. The most common error was where the right hand side of the expression was identical to the left hand side.

In (c) the location of the transformers either side of the transmission line was well known although occasionally they were placed the wrong way round. Other expressions from the box were very rarely used.

Question 9

Part (a) was well answered but (b) was poorly done.

In (a)(i) many candidates either did not know or chose not to use the terms gradient or slope. In (ii) and (iii) the calculations including the unit scored well across a wide range of candidates. In (iii) a common error was 70 x 10 = 700 N or conversion of 70 kg to 700 N before multiplying by the value of deceleration.

The answers in (b) almost always commented on the damage that the boy would do to himself if he did not bend his knees. Some described this in great anatomical detail. All but a few missed the point that increasing the time or distance for his change of velocity would result in less deceleration and so less force. Many based their answers on the pressure, area and force involved and some showed confused logic by referring to a shorter time to come to rest.

Question 10

This question was well answered.

In (a) it was anticipated that many candidates would use the angle given as the angle of incidence. This did not happen although some did use the formula involving critical angle. Occasionally the answer was left as the sine of the angle scoring the first two marks only. In (b) the drawing of the refracted ray in a medium of lower refractive index with the same angle of incidence was usually correct although the explanation was often contradictory with reference to a larger angle of refraction and more refraction as being the same thing.

In part (c) the added line required was the normal and this was usually drawn incorrectly as a vertical line and not always at the point of incidence. The second mark for the angle of incidence could still be scored. A significant minority of candidates considered the line labelling the glass block to be the incident ray.

Question 11

Part (a) often showed a lack of logic which was not seen in part (b). Expressions in (a) frequently showed either multiplication or division signs.

The calculation in (b) was well done although some tried to use distance /time to calculate the speed in (iii).

In (c)(i) candidates had to identify a material from its force-extension graph. The most common answer was 'spring' which with only a minority scoring for naming metal or any metal. Part (c)(ii) was disappointingly answered because many candidates who did know the answer to which region of the graph was associated with Hooke's Law wrongly or carelessly labelled it. Very often the apex of the graph was circled. The mark in (iii) could not then be scored.

Question 12

In part (a) the Left Hand Rule was widely known. Part (b) represented a type of question that has been set before testing knowledge of the direction of three quantities the third of which is related to the first two. This was well answered but some of the directions and labels were not clear and **M** was often bi-directional. In particular the direction of the current was not always shown in the short rod. Part (c) was well answered, the only lapse was not stating the type of change so 'current' instead of 'larger current' was occasionally seen.

In (d)(i) some loose descriptions of alternating current were seen. Given room for a diagram the safest strategy for the candidate is to give a labelled graph showing at least two cycles and a roughly sinusoidal variation about an axis. Many drew generators. Part (ii) was poorly answered. The movement of the rod would be closely linked to the variation of the current but a significant number of candidates thought that the force would always be greater because the current was alternating.

Question 13

In part (a) the subscript and superscript for the neutron were known by half of the candidates who went on to give the corresponding quantities for the beryllium nucleus. In (b) many candidates knew which of the particles from (a) was emitted during alpha emission but relatively few knew what was emitted during beta emission. A significant number thought it was the proton after explaining that a neutron decays to a protons and an electron. In (c)(i) the definition of the term isotope was well known although many dropped a point by stating 'same element' instead of 'same number of protons' for the first mark.

Part (c)(ii) tested the most able candidates. An answer showing three equations with the steps necessary for uranium-238 to decay by three successive emissions into an isotope of uranium was occasionally seen but the equivalent, in words, was often seen. A common error was the addition instead of subtraction of emitted particles from a parent nucleus. Sadly a disproportionate number of blank spaces was seen.

Question 14

In part (a) candidates had to fill in four gaps to complete a statement about nuclear fission. The second and third usually scored with answers of 'two' (or three) and 'chain' but the first rarely and the fourth occasionally. The term 'daughter' was not known and those candidates who did not answer 'speed' or 'velocity' for the fourth lost the mark for 'energy' instead of 'kinetic energy'.

In (b) the questions about the role of the moderator and control rods in a nuclear reactor were again poorly answered.

The main errors were identical answers in both parts, mixing up the roles of the two and that either could stop radiation from escaping or even that the moderator was a person

Question 15

The calculation in (a)(i) was very well done. Occasionally the formula PT = constant was used even though the correct formula is given in the paper. Some candidates may need their attention drawn to these formulae. Part (a)(ii) asked the usual question about the assumptions made in the calculation and was surprisingly badly answered.

In part (b) candidates had to correct a wrong statement that the speed of every molecule in the container is reduced as a result of a temperature rise. Almost all candidates knew that there would be an increase but nearly all thought that the speed of every molecule would increase.

The statement linking Kelvin temperature and kinetic energy in (b)(ii) required the word proportional to score the mark.

Question 16

About one quarter of the candidates scored the mark in (a) for the definition of voltage. Candidates should be reminded that a quantity must be defined in terms of other quantities and similarly for units.

The calculation in (b) was well done although a correct assumption in (iii) was rarely seen.

Part (c) eluded all but the most able candidates. A four-fold increase in energy transferred could be achieved by a doubling of the voltage or a quartering of the resistance. The usual answer was to increase both voltage and current four times although the first mark was often scored for doubling both.

4420 Physics Paper 03

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

Question 1

1a Nearly all gave 55(g).

1bi Nearly all recognised that the measuring instrument was a measuring cylinder though some suggested a measuring tube.

1bii Most gave 68 (cm^3) though some suggested 64 (cm^3).

1biii Nearly all gained this mark, either by giving 18 (cm^3) or by subtracting 50 from their answer to part ii.

1ci Many used correct answers to parts a and b, arrived at 55 ÷ 18 = 3.05555… and then gave 3.1 g/cm^3 as the answer. Full credit was also given if the candidate correctly used his or her answers in part a and/or part b to arrive at a final value to two significant figures.

1cii Many candidates gained the first marking point by noting that, at best, the data is only accurate to two significant figures. However only a minority were then able to express the idea that to give the result to more than two significant figures was to pretend to an accuracy it did not possess.
Of course, examiners credited the second mark in cases where the candidate had expressed the idea in his or her own words.

1di Most obtained both marks by giving the conclusion that, because the stones all have the same value for their density, then they are made of the same material. Some gave the conclusion that mass is directly proportional to volume or vice versa. Both responses resulted in full credit.

1dii Many wrote that she could not be confident because her results were not particularly accurate. However, only a minority went on to use data from the table to support their statement, for example, by stating that the volume of stone P could be anywhere between 10.5 cm^3 and 11.5 cm^3.

Question 2

This was the best answered Question with a significant minority of candidates gaining full marks.

2ai Most suggested a ray box or gave a description of apparatus which would give a ray of light. However, candidates should know that a light box is not the same piece of equipment as a ray box.

2aii Only a minority correctly stated that the position of the ray should be marked with points or crosses or pin pricks.

2aiii The angle was accurately measured by nearly all candidates.

2b Both angles were located and accurately measured by most candidates.

2ci Many candidates gained full marks. Where mistakes were sometimes made, they were, in order of frequency

- to fail to record the values in either ascending or descending order,
- to fail to mention angle, or give the symbol, anywhere in the table,
- to record one, or more, incorrect value(s).

2cii Almost without exception, graphs were completed to a very high standard; with very few examples of lines that were inappropriately thick or with over-large points or with the origin included as a result. The point 17,57 was usually clearly identified as the anomalous point. Although this identification was usually made on the graph, examiners awarded the mark if this point was identified in the table or near the instruction.

Question 3

3a Most correctly suggested that the purpose of the polystyrene pellets was to reduce heat loss from the small beaker.

3b Only a minority were able to state that, before taking its temperature, the water should be stirred. In the context of this Question, examiners were surprised that a significant minority suggested that the water should first be allowed to cool to room temperature.

3ci,ii and iii Hardly any candidates made a mistake in reading the scales in the diagrams; almost all realised that they must be an ammeter and a voltmeter, though a small minority had them the wrong way round.

3civ Almost all read the scales correctly and, where they did not, were still able to gain the second mark by correctly calculating the difference between them.

3d A small minority got into a muddle with elaborate theoretical digressions.

Amongst the many correct, practical responses were

- heat loss (1) by evaporation from the surface of the water (1)
- very difficult to ensure identical starting temperature (1) because if this is done by adding hotter or cooler water the same final volume has to be measured out in each case (1) (without any change in temperature)
- the water is at its maximum temperature at its boiling point (1) so there will be no increase in temperature after that (1) (if the power is increased)

Question 4

4a, b and c Nearly all carefully followed the instructions and secured all three marks.
A small minority went their own way, for example by inexplicitly swooping down to the surface from point B.

4di and ii A tolerance of ±1 degree was allowed, so answers in the ranges 59 ↔ 61 and 34 ↔ 36 were credited but not answers which resulted from a failure to follow the instructions.

4e Examiners were pleased to see, and to credit, a variety of thoughtful responses from many candidates. However some candidates failed to respond to the task they had been set and incorrectly went ahead on the basis that the oil could be treated as if it were a block of glass or transparent plastic.

In each case all three marks were awarded when

- a relevant problem had been identified,
- an appropriate solution had been indicated,
- there was an explanation, or expansion, of either of the first two points.

Examples of suitable, three-mark responses included

- it will be difficult to see what happens to the light after it enters the oil (1); add water to the container so the oil will float on it (1), now it is possible to see where the light reaches the bottom of the oil (1),
- it is difficult to see a ray of ordinary light in oil (1) so use a laser (1) which is much brighter (1),
- it will be difficult to mark the normal at D (1), use a vertical rod held in a clamp stand (1) to mark the position of the normal (1),
- it will be difficult to see the ray of light (1), blackout the room (1) so that there is a good contrast (1),
- it is difficult to see through some types of oil (1), use a pale oil, such as vegetable oil (1) and a powerful source of light (1).

4420 Physics Paper 04 (Coursework)

The total number of centres entering candidates for this component of the examination increased again this year. Five home centres entered candidates this year, which is also an increase on last year.

The moderating instrument used was the Sc1 criteria as used by home centres, using exemplars provided by the JCQ (Joint Council for Qualifications) as a guide.
Centres entering students for the coursework component of the iGCSE examinations in 2008, therefore had their coursework moderated to the same standards as for all home centres.

A range of tasks was seen this year. The most common was resistance in wires (or filament bulbs). This is the most common Physics task seen in UK centres, and it can achieve the full range of marks.
One centre did "proving Hooke's Law" which is not recommended as this is not a true investigation, and in addition it is very difficult for students to access sufficient scientific knowledge to gain full marks in planning and analysis.
Some other tasks seen this year included the wave speed in a range of depths of water, electromagnets, moments, marble on a ramp, the heating power of a microwave and a pile driver task. One new task seen by the moderators was the deflection of compass needle by a magnet at variable distances.

Centres are reminded that to fully achieve P8b, students 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 students 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, students 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 students were generally unable to actually 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 students being given credit for simple statements of what they might do next.

PHYSICS 4420, GRADE BOUNDARIES

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

	A*	A	B	C	D	E	F	G
Foundation Tier				55	44	34	24	14
Higher Tier	71	59	47	35	25	20		

Option 2: with Coursework (Paper 04)

	A*	A	B	C	D	E	F	G
Foundation Tier				58	46	35	24	13
Higher Tier	75	63	51	39	27	21		

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

Further copies of this publication are available from
Edexcel UK Regional Offices at www.edexcel.org.uk/sfc/feschools/regional/
or International Regional Offices at www.edexcel-international.org/sfc/academic/regional/

For more information on Edexcel qualifications, please visit www.edexcel-international.org/quals
Alternatively, you can contact Customer Services at www.edexcel.org.uk/ask or on + 44 1204 770 696

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH