Examiners' Report Summer 2008

GCE

GCE O Level Physics (7540)

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

Contents

GCE O Level Physics

Examiners' Report June 2008

7540-01 Paper 1

General Points and Observations

The vast majority of candidates were able to complete the paper in the allocated time. Calculations were particularly well done especially in Q2(c) where five marks were concerned. Some descriptive work showed some muddled thinking especially in Q5(b), Q10(a)(i) and Q10(b)(ii). The standard of drawing required for the ray diagram in Q11(a)(i) was very good in contrast to the drawing and labelling of forces in Q1(b)(c)(d).
A significant number of candidates are still writing responses which are not restricted to the spaces provided and those using extra sheets rarely gain further marks. In many cases maximum marks have been awarded before these sheets have to be considered.

Question 1

Many candidates found this to be a difficult starting question.

(a) 90% of candidates scored the mark for the calculation of the weight of a car giving the correct unit.

(b) The confusion that many candidates had with (c) and (d) seemed to affect this earlier part of the question where candidates were asked to draw a labelled arrow showing the direction of the weight of the car given its centre of gravity. Instead of vertically downwards a significant minority of candidates showed the arrow parallel to the inclined road.

(c) Very few candidates showed the arrow going up the slope for the frictional force between the ground and the front wheel. Nearly all showed it going down the slope possibly mistaking it for the air friction force.

(d) The normal reaction force acting on the front wheel was often shown correctly.

The arrows shown in (b)(c)(d) were nearly always clear in their direction and adequately labelled.

(e) The reason why it would be unsafe for the centre of gravity to be located nearer the rear is that the car might 'topple' backwards. Candidates used a range of suitable terms to express this but many merely stated that the car would 'move' backwards which was not sufficient the mark.

Question 2

This question was exceptionally well answered by candidates from a wide ability range.

(a)(b) A very high percentage of candidates knew that the momentum of a pair of skaters at rest was zero and that momentum is a vector quantity.

(c) The calculation that called for recall of momentum and its use together with a knowledge of an appropriate unit was performed to a very high level. The most common of the five marks to be dropped was for the unit given as kg/m/s instead of kgm/s.

Question 3

The last part of this question proved to be confusing for many candidates.

(a) Most candidates were able to provide a missing piece of data for extension given a table of readings of weight applied and the corresponding extension of a copper wire.

(b) Most were able to state over which range of readings Hooke's law was obeyed and give a reason.

(c) Candidates were asked what would be the effect on the length of the wire if the weight were removed after an extension which was (i) within the region in which Hooke's law was obeyed and (ii) beyond it.
Answers often referred to the effect on extension rather than length and some gave answers that could have referred to both without being specific.
An acceptable answer in (i) was 'returns to original length' not merely 'gets smaller' but more often 'goes back to zero' was seen. Similarly in (ii) 'none' would be acceptable but often 'gets longer' rather than 'becomes permanently stretched' was seen.

(d) The explanations for the answers in (c) needed to be in terms of elastic limit but were more often in terms of Hooke's law which had already been tested.

Question 4

Marks for this question were above average although many candidates were not clear about the concept of efficiency.

(a)(i) A quarter of candidates did not know how much energy was supplied to lamp when working normally at 0.3 W for one second.

(a)(ii) Given an efficiency of 40% candidates had to show that that 0.75 J had to be supplied every second. There were several ways of scoring this mark either starting or finishing with 40% but more than a quarter of the candidates got lost and presented an illogical process that did not warrant the mark.

(a)(iii) Half of the candidates were successful in this more difficult calculation for the rate of mass of water through a turbine given the energy supply previously quoted. The main error, apart from not using a value for *g* or a unit penalty for mass, was to assume that the input energy was 0.3 J instead of 0.75 J.

(b) A high proportion of candidates knew that heat was the other form of energy emitted by the lamp apart from light.

Question 5

This was the most poorly-answered question on the paper.

(a) Disappointingly a quarter of candidates did not know that molecules in air would move faster when heated.

(b) Asked why the volume of trapped air would not double when the Celsius temperature was doubled, hardly any stated that Kelvin temperature had to be considered and that on this scale temperature was not doubled. Instead candidates almost always tried to justify reasons for a breakdown of this gas law under the circumstances given.

(c) The reason for using concentrated sulphuric acid to trap the air was known by a minority of candidates.

Question 6

This was well answered with a calculation that needed care when dealing with a large number of zeroes.

(a) More than 90% of candidates knew that a charged sphere would experience a force of repulsion when brought towards a similarly-charged stationary sphere and that this force would continue to increase as it was brought closer.

(b) Some errors in the calculation in (i) arose from candidates using the equation
$P = VI$ instead of $E = VQ$ and proceeding to find a current in amps instead of a charge as requested. In (ii) the value of time for this charge to pass could be worked out independently of (i) although some candidates successfully took a longer route to the answer and used the data from (i). The main error here was to calculate 0.0004 s from
$t = 2/5000$ instead of 0.004 s from 0.0080/2.
In spite of these difficulties this calculation was performed well by the majority of candidates.

Question 7

This was very well answered. A simple beginning followed by a testing calculation showed this to be a topic that is widely understood.

(a)The addition of an ammeter and a voltmeter to make a circuit suitable for the measurement of a resistance was well drawn. Occasionally the two meters were shown in series and a significant minority of candidates inexplicably showed an incomplete circuit with one connecting lead completely missing.

(b) 80% of candidates knew that of the two meters the voltmeter had a very high resistance.

(c) Candidates showed a good knowledge of resistors in series and parallel. Calculations were skilfully performed. Often the resistance of a particular combination e.g. two series resistors in parallel with another one were calculated from a single formula.

(d) Candidates generally knew which combination would allow a greater current to pass.

Question 8

The topic of electromagnetic induction again proved troublesome.

(a)(i) Candidates were shown an electromagnet with both poles marked and asked to draw one magnetic line of force. Normally this would have scored highly but with a metal wheel placed between the poles many candidates were reluctant to draw a line that went through the wheel. Some lines drawn around the wheel were correct but many showed the line on the wheel presumably associating it with the line already drawn on the wheel indicating its motion.

(a)(ii) The standard question for three marks asking why there is a current in the wheel usually referred to magnetic field lines being cut but the word 'induced' was often missing and hardly any referred to the wheel as being a conductor of electricity.

(b) The wheel in question slows down and candidates were asked to draw a graph of speed against time for the wheel to show the braking effect of the electromagnet. 50% of the answers were correct showing a general downward trend.

(c) Only a minority of candidates thought that the current flowing in the wheel would raise its temperature.

Question 9

This question based on recall of sub-atomic particles was disappointingly answered.

(a) Although candidates could not complete a section of a table to show the relative masses of the proton and neutron compared to the electron, it is puzzling as to why they were also not able to do so for the charge as well.

(b) 80% of candidates could name an example of an ionising radiation that did not contain any of the aforementioned particles.

(c) Candidates were asked to choose from the three particles which one would be most deflected in a magnetic field. Although many chose the electron it was often for the reason that it was negatively charged rather than being the lightest

Question 10

This question showed great competence in recognising diffraction and performing a calculation contrasting with poor attempts at accounting for wave behaviour.

(a)(i) 80% of candidates recognised and named 'diffraction' from a diagram showing plane waves moving through a gap of comparable size to their wavelength.

(a)(ii) Less than a quarter of candidates could account for the shape of the emerging waves. Many did not refer the relative sizes of the gap and wavelength but instead said that the waves were 'circular'.

(b)(i) The calculation of frequency given values of speed and wavelength was very well done. Again the correct number of zeroes were shown along with the unit. Those who used standard form were invariably correct.

(b)(ii) The knowledge that light waves had a smaller wavelength than microwaves was not generally known as the reason why light waves would behave differently when passing through the same gap.

Question 11

This question was very well answered with candidates showing good drawing skills and knowledge of the nature of images formed by lenses under certain conditions.

(a) Given the positions of an object, image and lens, candidates were asked to draw two rays to show the image formation and mark in the position of the principal focus. Candidates are best advised to draw from object top to image top although other rays could score. However rays drawn along the principal axis were not helpful.

(a)(iii), (b)(i)(ii) These questions on the nature and size of am image were successfully answered and contributed to a question that scored above average.

GCE O Level Physics

Examiners' Report June 2008

7540-02 Paper 2

General Points and Observations

This paper again featured a layout to enable the use of online marking which was introduced in the January 2007 examination. Candidates were required to answer questions on the spaces provided on the question paper. It was disappointing to see that some candidates still repeat parts of the question before starting their answers and then find it difficult to fit their answers in the remaining space. A significant number of candidates extended their answers beyond the space provided or continued their answers on one of the blank pages; centres should stress the need to complete answers within the space provided wherever possible. It is essential that candidates indicate clearly within the space provided that the answer continues elsewhere. The majority of candidates were able to attempt all parts of the paper in the time allocated. Many wrote good answers to questions requiring explanations of physical principles but some of it was irrelevant, incorrect and could be contradictory. A little over quarter of the marks were gained from calculations and these were generally answered well although units were still being missed off or written incorrectly, particularly in Q4. In questions where candidates were expected to show that the result was approximately equal to a given value, candidates did not always show all steps in their working, did not provide a result quoted to a suitable number of significant figures and instead jumped to the value given to them in the question.

Question 1

Well prepared candidates scored well on this question.

Q1(a)(i) This calculation was usually well done. The main errors were either failing to subtract the frictional force or adding it, incorrect rounding of the final answer or failing to show the full working out.

Q1(a)(ii) Many candidates gave the two required points that the cause was air friction and that it increased with speed. A few candidates stated that the ground friction increased despite the clear statement that it remained constant.

Q1(a)(iii) The majority of candidates scored both marks.

Q1(a)(iv) Almost all candidates scored full marks here by using average speed times time. Very few candidates rounded off their calculation by stating that 688 metres was less than 700 metres but were not penalised. Credit was allowed if they showed correctly that the speed at the end of the 700 m runway was greater than 55 m/s or the time to reach the end of the 700 m runway was more than 25 seconds.
A minority used the equations of motion incorrectly and hence lost marks.

Q1(a)(v) This was weakest part was as candidates often missed the point of why the wheels are folded into the body. There was confusion in the minds of a minority of candidates who answered in terms of "air pressure" variations, "heating of the tyres", "exploding tyres" and the undercarriage being torn off the plane.

Q1(b)(i) Most candidates could name one piece of apparatus needed. Many ignored the newtonmeter shown in the diagram and wanted to use elastic bands to provide the force. Many also suggested a balance was needed even though the two variables in the experiment were force and acceleration.

Q1(b)(ii) The majority scored full marks here. A minority did not seem to read the question carefully and used a "stopwatch" when a ticker tape timer was given; some used elastic "bands/cords" when a newtonmeter was given on the diagram. It was expected that the acceleration would be calculated from the ticker tape and not from F = ma which defeats the purpose of the experiment.

Q1(b) (iii + iv) The majority scored well here, realising that friction had not been compensated for but many failed to explain that they needed to tilt the runway so that the trolley moved with constant speed or velocity.

Question 2

Candidates often scored well on this question.

Q2(a)(i) Most candidates were able to score full marks although a few misread the data. Too many still confused mass and weight stopping at 8.4 kg or even writing 8.4 N.

2(a)(ii) There are still an inexplicably high proportion of candidates who work in ^{o}C rather than K when doing this calculation. The examiners decided to award a maximum of 1/3 for this incorrect physics, despite the fact that candidates had been asked to show that the new volume was about 8 m^3. Some lost the final mark by not showing the actual result of their calculation rounded to an acceptable number of significant figures.

2(a)(iii) Was usually answered correctly.

Q2(b)(i) and 2b(ii) were almost invariably answered correctly

2(b)(iii) Showed imprecise and woolly thinking in a large number of cases, stating molecules would move fast rather than *faster* or that there would be more collisions rather than more *frequent* collisions. A few candidates failed to score as they wrote in terms of *air* rather than *molecules*. A worrying number of candidates thought that molecules *expand* and become *less dense* when heated or that gas molecules *vibrate.*

Q2c The graph scored highly. A few candidates, including some of those who otherwise scored highly, missed out the units on the label axes. A significant proportion of candidates had difficulty with the given upthrust scale when plotting values >100 N. Candidates need to ensure that their points are clearly visible. A dot with a circle or a cross are much preferred to a dot. With online marking dots alone are difficult for the examiners to see. Interpretation from the graph was generally good. In 2c(iv) it was pleasing to see a number of clearly presented and correct answers in terms of weight and upthrust. However too many candidates ignored the context of the question and just talked of hot air rising or faster molecules hitting the top of the balloon and hence pushing it upwards.

Question 3

Many candidates found parts of this question very demanding.

Q3(a) A lot of good answers were seen here. In part (i) a minority tried to explain what was shown in terms of total internal refraction. In part (ii) a majority stated that refraction occurred with many saying it was because the ray bent towards the normal. It is clear that the term "density" confuses many candidates. In (iii) a surprising number incorrectly believed A was brighter.

Q3(b)(i) Far too many candidates failed to score here due to putting one or more 'arrow' in the wrong direction on the rays. Common errors were a ray from the eye to the prism or a double arrow [pointing both ways] on some rays.

Q3(b)(ii) Most candidates realised that the coating was there to reflect light. Some failed to score by again trying to include total internal reflection or by saying what it prevented the light passing through.

Q3(b)(iii) Most candidates failed to understand the question and said the light would be too dim or that the driver would not be able to see the car *behind*.

Q3(c) All four parts were generally answered well. The common mistake in (i) was to use 17º/ 11º instead of sin 17º / sin 11º. Many candidates did not show all steps in their working. In (ii) most realised that total internal reflection was taking place here but some did not realise that "reflection" was not a good enough for the answer. The word "reflaction" did appear and it seemed to be a composite of 'reflection' and 'refraction' and therefore did not score. In part (iii) good candidates showed all steps in their working to obtain 41.8º and then would quote a slightly bigger angle, saying in (iv) that the angle had to be larger than (or equal to) the critical angle.

3(d) Although many candidates' descriptions were difficult to follow they scored well by drawing clearly labelled diagrams. Some labelled the angles i and r the wrong way round where the ray emerged from the block. A small number of candidates chose to use a real and apparent depth with no parallax method and it was possible to score full marks with this method. Some candidates showed a semicircular block or triangular prism.

Question 4

Once again a radioactivity question was not answered well. Centres are reminded that candidates should fully study all sections of the syllabus.

Q4(a) In general candidates found this difficult. The answers showed that many candidates are not familiar with working with units as an aid to understanding. In part (i) candidates were expected to show a clear understanding of both kilowatt-hours and of kilojoules. Most recognised that 1 hour was 3600s but not that a kilowatt was 1000 W hence showing that

0.1kWh = 360 000J. Some in (ii) went on correctly to obtain 9 kJ but then in (iii) gave an answer of 1.8 s neither recognising that this was rather too short a time to be sensible nor that it was 9000 J not 9 J that they had used.

Q4(b) Part (i) was almost always fully correctly answered, although many candidates handwritten numbers were difficult to decipher. In (ii) only rarely did candidates show how they arrived at 2 x 88 years. A worrying proportion gave the answer as 44 years (1/2 x 88) or 22 years (1/4 x 88). Part (iii) was seldom correct with the main error being due to failing to realise that the source of energy was nuclear.

Q4(c) Candidates usually scored both marks provided they talked about alpha particles. Some however wrote of aluminium being a good conductor of heat and so able to dissipate the heat produced by the radiation.

Q4d (i) Even good candidates struggled with this calculation and because their working was difficult to follow examiners had to try very hard to find marks they could award. Correct answers came in many different forms. In addition to the hoped for answer of 4 hours some candidates proved that 5% efficiency was correct, that 0.002 kg was a sufficient mass of the battery and that 5 W was produced by this battery. The difficulties arose because the candidates tried to work out the answer in an inconsistent set of units. A simple solution was to show that the battery could provide 400 Wh (if it were 100% efficient) that 5% of this was 20 Wh and then divide by 5 W proving 4 hours. Many candidates extended their calculation to Joules and got involved in very large numbers and began to 'mix' their units. There were a small number of ways in which this calculation could be performed quite simply but there were many, many variations, which were more complex, and unfortunately the vast majority of candidates chose to attempt by one of these more difficult methods. Very few explained what they were trying to do and simply wrote numerical solutions.

Q4d (ii) A disappointingly small number of candidates scored the maximum mark here as they talked about the efficiency of the battery rather than addressing the fact that a radioactive isotope was involved which had a long half-life and would hence last far longer than four hours.

Question 5

Many candidates were unfamiliar with the experiment in part (b) and often wrote about something completely different, even though it had been explained to them in the stem.

Q5(a)(i)–(iv) It was pleasing to see that most candidates were scoring well on the definitions of amplitude, frequency, wavelength and resonance. The answers were expressed in a multitude of different ways and, in general, they were acceptable. Those who used labelled diagrams to help define wavelength and amplitude were more likely to score the marks. It should be stressed that amplitude is the maximum displacement from the mean position as some candidates thought that any height above the mean position would do for the answer. Some candidates thought that the wavelength was the distance between two crests (or troughs) and failed to realise that it must be adjacent crests (or troughs). Some indication that it is the distance between one crest and the next crest is needed. Explanations of resonance were better and more clearly expressed than in the recent past.

5(b)(i) Most candidates scored the one available mark

5(b)(ii) Few candidates were able to provide more than two acceptable items.

5(b)(iii) There was a wide range of marks scored. There were some clear answers. On the other hand some candidates did not use a tuning fork, as required by the question, but chose to use a signal generator to vibrate the wire. Some candidates used a stopwatch used to measure the time while a certain number of vibrations were counted. An unusual, and common error in some centres, was the idea that banging the single tuning fork harder altered the frequency to give a whole complete range of frequencies for the experiment. They did not appreciate that tuning forks have different, fixed frequencies and therefore the length of the wire between the movable blocks had to be varied to make the frequency of the wire match that of a particular tuning fork. They seemed to think that the frequency of a fork could be varied to match a fixed length of the wire. The need for repetition was not understood; candidates gave a vague statement "repeat the experiment" without amplification. They needed to recognise that to repeat at same frequency was a check for accuracy and to repeat at a different frequency was a search for a relationship.

5(b)(iv) There was a lot of careless work. These were easy marks but a lot of candidates did not include the units (as part of the column headings) and a significant number did not draw a table as required by the question.

Q5(c) Most candidates scored the single mark. If they ignored the instruction to label the axes they were not penalised but some used the wrong variables on one or both axes and lost the mark.

Q5(d) Extremely few candidates realised that the wave speed was independent of frequency. They failed to score the graph mark in (i) and so could not then score in part (ii). Those who drew the correct graph almost invariably scored both marks.

PHYSICS 7540, GRADE BOUNDARIES

Grade	A	B	C	D	E
Lowest mark for award of grade	73	63	54	49	30

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demands 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: 190 High Holborn, London WC1V 7BH