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Examiners' Report January 2007

GCE

GCE Salters Horners Physics (8552/9552)

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Contents

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6751 Unit Test PSA1

Question 1

Candidate responses tended to show that they had a general understanding of the topics being tested by this question, but their answers often lacked the precision needed to demonstrate significant progress beyond GCSE level.

Responses to parts (a), (b) and (e) were all affected by some candidates failing to realise the significance of the initial velocity being zero. In the first part they tended to mention air resistance, but rarely that it was initially zero. A significant proportion simply referred to 'other forces' without naming them. Answers to part (b) were expected to refer to $v = u + at$ and then take $u = 0$ into account, but many just tried to explain in terms of $v = at$.

More candidates were able to explain that an average velocity was represented in part (c), although some failed to read the question properly and gave answers in part (i) for the whole formula. In part (ii) answers were often incomplete and referred only to time or distance and not both.

Part (d) gave few problems. In part (e) most candidates could identify an appropriate formula and substitute values for the quantities, although a number failed to use $u = 0$ and some others substituted an incorrect time. Some did not follow the instruction to use formulae from the list.

Question 2

Most candidates could label the circuit correctly, although some failed to explain how the measurements were obtained. The first resistance calculation was completed successfully by the vast majority, and most could find the second resistance as well, although some calculated the current and thought this was the resistance.

In explaining the difference in values of resistance candidates tended to mention vibrations of lattice ions but not that they increased with increasing temperature or the specific effect on the charge carriers.

Question 3

The processes involved in the emission of light were not well explained by most candidates in part (a). They often mentioned atoms being excited, but descriptions in terms of electrons and energy levels were not always clear. Candidates mentioning electrons falling between levels sometimes simply referred to light being emitted, as in the question, and didn't mention photons or electromagnetic radiation.

In part (b) the calculation was generally completed successfully, although some omitted the unit, but they often failed to identify a specific wavelength or frequency when explaining the spectral line.

Candidates usually knew that atoms of different elements had different energy levels. Within their explanations there was often a statement that showed a link between frequency and colour, although this was not always stated clearly. A connection between the photon energy and the difference between energy levels was more rarely made.

In part (d) candidates remembered to refer to right angles for transverse waves, but descriptions frequently used imprecise language, often using the words ‘move’, ‘movement’ or ‘motion’ and failing to distinguish clearly between two sorts of ‘movement’ being described. “The movement is at right angles to the direction of the wave,” is typical.

Question 4

Labelling forces presented no difficulties.

Most candidates could calculate the horizontal component of *P*, although some used sine, but some did not realise that this was also the horizontal component of *T*. There were a number of opportunities for error in the calculation of the magnitude of *T*. These included the use of the wrong trigonometrical function, the wrong angle and the wrong force and all of them were seen. Many, candidates, however, completed the calculation in a straightforward way.

Virtually all candidates found the correct length for *P* in the vector diagram, although some used 65 degrees as the angle to the vertical. Correct completion of the rest of the vector diagram was seen much less frequently. Most added *P* to *W* tail-to-tail rather than tip-to-tail and then simply completed the triangle whereas the drawing they had now produced should have been completed as a parallelogram. Those who added *P* at the lower end of *W* completed the diagram correctly and found the resultant.

Suggestions for forces acting on the wheel were often very general and lacked the required detail. ‘Air resistance’ was frequently stated barely without an indication of its origin.

Question 5

Candidates usually completed the first two calculations successfully, although a significant minority calculated the answers in the wrong order, using the formula for heat gained from the formula list for part (a), and then swapped them over when they realised this.

Candidates readily applied the efficiency formula from the paper, but often they did not appear to read the second half of the question so they calculated an efficiency at supplying heat energy rather than light energy.

In part (d) candidates frequently described the shape of the graph without reference to the quantities shown rather than attempting to explain it, as asked in the question. There was rarely any mention at all of heat energy lost by the water, the only mark awarded often being for noting that the rate of temperature rise was decreasing.

The confusion over the efficiency shown in part (c) was reflected in part (d). Most candidates also thought that doing the experiment for longer improved the result. Where credit was given it was usually for stating that the temperature stopped increasing after a certain point.

Question 6
Candidates usually described ‘digital’, if somewhat briefly.

Many candidates failed to mention interference or superposition in any way in part (b). Most successfully calculated the path difference, and many related this to half a wavelength, although there was sometimes confusion between path difference and phase difference. Some candidates simply said ‘out of phase’ instead of using more precise reference to ‘antiphase’. A number made vague references to some light travelling further than the rest in terms of intensity.

While candidates often realised that being in phase was connected to coherence, the constant phase relationship was rarely mentioned in part (c).

In part (d) many candidates basically described the principal focus, thinking that was the whole answer, and others just referred vaguely to a point through which all light rays passed. They often didn’t address the ‘length’ part. Diagrams were often indicative of further understanding, but many needed better labelling or more care to make the incident rays actually look parallel.

A large proportion of candidates were able to arrive at the figure of 15.3 in the bit calculation, but a number failed to round this to the required whole number. Those who obtained the number 15 rarely had difficulty labelling the bits. Similarly, those who did not complete the calculation could often identify the rows where the bits were found, but did not identify the white areas in these rows as relevant.

6752 Unit Test PSA2

The level of the paper seemed to be appropriate, with many candidates making a good attempt at all the questions. There was no evidence that time was short. As always, calculations were answered in general better than those questions needing some discussion or explanation. Questions 3 and 4 proved to be the most difficult for candidates. These covered electron energy levels, ray diagrams and total internal reflection.

Question 1

This question was generally well answered by candidates. The majority correctly used the term “laminar” or “streamline” for the first part. Most candidates could correctly sketch the airflow pattern around the ski jumper; however, candidates should note that the streamlines needed to be smooth, continous and not touching to gain both marks. Many answers to (a) (iii) were too general to gain the mark, for example stating that the equipment was “aerodynamic” or “streamlined" without giving any specific thought as to the design. The majority of candidates correctly identified a desirable and undesirable property from the list, although it was clear that some had not read the question fully, answering in terms of the ski jumper’s clothes rather than the skis. The definitions of elastic and plastic were generally correct, however a significant minority of candidates clearly do not understand what is meant by the word *tough*.

Question 2

Although many candidates obviously understood the principle of the pulse-echo technique, many failed to gain both marks by not discussing the necessity of knowing the speed of the wave, or forgetting to halve the time taken. Some candidates confused this technique with that of the Doppler effect. Few of the answers to (a) (ii) related the density *change* to the amount of reflection. The calculations were generally well answered, although a significant number of candidates used an incorrect power of 10 for MPa. A common error in the strain calculation was to substitute the value obtained for force rather than that of stress. Almost all candidates correctly stated that the concrete was *brittle*.

Question 3

Marks were lost by some candidates for careless drawing on the energy level diagram ie. arrows not starting / ending on an energy level. The majority drew arrows of the same length for absorption and emission. Although many candidates suggested that the missing energy caused a temperature rise, very few stated *what* would heat up. Most answers to the calculation gained at least two marks for the use of $f = c/\lambda$ and $E = hf$. Many candidates failed to realize that the minimum energy would correspond to the maximum wavelength or did not convert the answer into eV. A few candidates used the value for wavelength rather than frequency in the $E = hf$ equation. The majority correctly stated that the forgery would glow / emit light.

Question 4
Many candidates correctly calculated the critical angle. A surprising number of candidates, however, could not complete the ray diagrams. It was common to see rays bending towards the normal in the first diagram and in the second the ray was often refracted rather than reflected. The reflected angle was also often clearly different from the incident angle. The angles were generally labelled correctly although a few candidates did not show any normals on their diagrams, even though the question asked them to add these before drawing the rays. The rest of the question discriminated well. Only the better candidates could correctly discuss the relationship between refractive index, critical angle and total internal reflection. Weaker candidates gave very confused answers to this section and showed little understanding of these ideas. Answers to (b) were again often confused with many candidates correctly stating that the critical angle would be smaller but thinking that this would lead to less reflection and hence less sparkle.

Question 5
The first part of the question was poorly answered with many candidates simply stating that the car would waste energy or couldn't be turned off. Although the ratio in (a) (ii) was understood by most, errors in calculating powers of 10 were common. For part (b) many gained 1 mark for lead shielding, however, few commented on exposure time as a factor. Many candidates believed that background radiation was due solely to natural sources which led to confusion when answering the final section. Many of the answers to the last part were vague or had no scientific basis.

Question 6
This question also discriminated well. Almost all correctly stated that a log scale would be needed to plot the values. The discussion as to why carbon is a good choice was poorly done. Few related resistivity to length or thickness and many stated that it had the lowest resistivity value in the table. The calculation was very well done by almost all. In part (iv), many candidates referred to current rather than potential difference or discussed the insignificance of 0.5 Ω without making any comparison with the rest of the circuit resistance. The better candidates were able to calculate the new potential difference.

Question 7
The line of best fit was often drawn as a straight line or did not pass through the origin. Curve drawing was generally poor. It would be helpful if candidates drew lines in pencil so they could be erased if an error was made. Many decided to cross out the original line drawn in pen and add a new one which does lead to some confusion. It was not uncommon for candidates to incorrectly read the value of extension from their graph and many missed the 'mm' on the axis. Very few candidates knew that the gradient would give the stiffness of the wire. The majority gained only 1 mark for the final section, stating how the graph would be different but not offering any explanation.

6753 Coursework PSA3

There was a very small entry in this module: only 114 entries were eventually received. In view of the small number of scripts examined, no changes were recommended to grade boundaries, and the comments below are necessarily more limited and of a more general nature than in the summer.

The moderators were very grateful once again for the full documentation and annotation provided by most centres. Copies of the briefs given to students and the annotation are invaluable in helping moderators to make decisions, as are details of internal standardisation which is required in centres using more than one assessor, along with details of teaching groups. Some centres are still not fastening a candidate's work together securely, nor using the latest documentation. This is now provided in the specification, and by the Assessment Leader to known centres. Some centres sent the top two copies of the OPTEMS to moderators - the top copy should go directly to Edexcel. Also both moderators and Edexcel need to be informed that centres have withdrawn candidates. Centres are reminded not to use a delivery system for coursework samples which requires a signature from the recipient.

In such a small entry only a limited number of experiments were seen. The majority were appropriate, although as noted in previous years, those which did not lead to numerical results limit the mark which can be obtained in the evaluation of results. Two new variations were the determination of the Young's Modulus of Scoubidous (plastic plaiting material), and the viscosity of bath oil. Centres are reminded that candidates should only be awarded marks for Skill A in the part of their work which is clearly written before the experiment is carried out. The plan should be written in the future tense and should be clearly distinguishable from the rest of the report, so that it is clear that safety, accuracy and sensitivity have been considered in planning rather than evaluation.

A new destination for a visit was a tyre company. Reports on visits were generally good; however, candidates should consider carefully the presentation of their work. This is the only part of the AS specification where use of English is assessed, and poor work should not be awarded four marks for Skill C. In addition, word processing is necessary for the highest marks. It is useful for moderators if candidates number pages of their reports for both the experiment and the visit.

Centres are encouraged to use the free coursework consultancy service for advice about suitable experiments, visits, projects and marking. If in doubt about the procedure for resubmission of coursework, centre should consult the circulated FAQs.

6754 Unit Test PSA4

This paper appeared to perform satisfactorily. Most candidates attempted to answer most questions. Most were able to understand the context and physics behind each question, and what was required to answer it.

This paper was marked by the "epen" computerised marking system for the first time. This makes it more important than ever that candidates present their work well. They should write clearly, legibly, in dark ink. They should as far as possible write only within the spaces provided. If there is work carried over to other pages or to an inserted page, they should refer to it in the space for the answer.

Question 1

(a)(i) This part of the question was quite well answered by most candidates, but it was common for 1×10^{-10} F to be stated as comparable with 10 pF, or to be written as 10×10^{-9} F and then equated to 10 pF.
(a)(ii) and both parts of (b) were generally answered correctly - except that in (b)(ii) a significant minority failed to use the charge for an electron in the equation $F=Eq$, inserting instead the charge from (a)(ii).
Part (c) was found difficult by most; there was a lot of confusion about how to apply the equation $E=V/d$ to this situation.

Question 2

(a) An alarmingly common wrong answer was to state that unlike charges repel.(b) and (c) Most were well informed about these facts. The most common mistakes were omitting the unit for charge, and assigning a negative value to the mass.
(d) A large fraction of the answers to this part of the question indicated that candidates did not really understand the units GeV/c^2, as they were intent on using $\Delta E=c^2.\Delta m$ for this part. Most were able to gain the one mark available for correctly interpreting G as "x 10^9".
(e) The better answers referred to kinetic energy, but some candidates made oblique references such as, “the particle has energy due to its movement / speed” . There were also some references to "heat".
(f) Surprisingly, many candidates who had got part (d) wrong were nonetheless able to obtain the correct answer to this part of the question. Those not obtaining the correct answer often omitted the conversion from eV to J. Again this seemed to point to relative confusion about the units used in this part of the specification.

Question 3

(a) It was pleasing to see many good answers to this drawing task. A common mistake was to draw a right angle between R and D. The correct answer was sometimes obtained by a calculation, with the accompanying diagram falling short of the mark.
(b) This part divided cleanly into those who could do it and those who couldn't - possibly correlating with those doing/not doing A level maths?
(c)(i) The answers rarely referred to a change in direction; instead candidates chose to state what would happen if there were no resultant force (i.e. Alex would continue in a straight line).
(c) ii) Many candidates thought that centripetal force is a force in its own right. One or two answers referred to centrifugal force or the spinning force. Those who identified the push from the ice often failed to specify the horizontal component. Some candidates seemed to think that the weight force had a horizontal component.
(d) Most could quote $F=mv^2/r$; but few used the horizontal component of P as the centripetal force.

Question 4

(a) Most candidates were able to identify *E* as an (induced) emf, and a good fraction of these answers linked the emf to a change in flux.

(b) Most mentioned Lenz for one mark; there was some pretty convoluted language to explain the idea of an opposing effect, which was marked quite generously - but then even a correct explanation is pretty convoluted, isn't it!?

(c) Lots of confusion in answers to this part of the question. Those candidates who had described *E* as an electromotive force in part (a) often went on to talk about *E* as a force in this part of the question. Given that some candidates really thought that *E* was a force, it is questionable that teachers should be teaching about electromotive force rather than just referring to *E* as an emf. Many candidates did not take the hint of the first two parts of the question to refer to induced emf, instead choosing to use an energy argument. The best answers came from those who realised that *current* is the key to the question.

Question 5

(a) Only a few candidates were fooled by the shape of the magnet, but many more lost marks by drawing poor or careless diagrams that had flux lines crossing, merging, or changing direction.

(b) Some good answers to this part of the question. However, while quite a number quoted Faraday's equation, few realised how it could apply directly to this situation and the graphs shown. A lot of answers showed a misunderstanding of the described event, or confusion with the basic ideas. Quite a number of answers referred to a north pole followed by a south pole to explain the negative part of the graph. Some candidates were obviously familiar with similar questions where a magnet is dropped through a coil, and chose to describe this instead of the situation actually given here.

(c) and (d) Most, except for the weakest candidates, could do these parts.

(e) A good number of candidates were able to this part well. Those who didn't either left the space blank, calculated the area of the disc, combined numbers together in a random fashion, or tried to bring in the magnetic equations used in the previous part of the question.

Question 6

Some very good answers to this question. Those candidates who lost marks often did so by using $\log_{10}$ instead of $\log_e$ or omitting units for μ.

Grade boundaries

The raw mark obtained in each module is converted into a standardised mark on a uniform mark scale, and the uniform marks are then aggregated into a total for the subject.

The table below shows the boundaries at which the raw marks are converted into uniform marks. Raw marks within each grade are scaled appropriately within the equivalent range of uniform marks.

Units converted to 100 uniform marks

Unit	Maximum mark	Grade				
		A	**B**	**C**	**D**	**E**
	Uniform marks 100	80	70	60	50	40
	Raw marks					
PSA1	60	38	33	29	25	21
PSA2	60	42	38	34	30	26
PSA3	60	50	45	40	36	32

Units converted to 90 uniform marks

Unit	Maximum mark	Grade				
		A	**B**	**C**	**D**	**E**
	Uniform marks 90	72	63	54	45	36
	Raw marks					
PSA4	60	41	36	31	26	22

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