OCR
RECOGNISING ACHIEVEMENT

GCE

Physics B (Advancing Physics)

Advanced GCE **A2 H559**

Advanced Subsidiary GCE **AS H159**

Report on the Units

January 2009

H159/H559/MS/R/09J

Oxford Cambridge and RSA Examinations

This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

OCR will not enter into any discussion or correspondence in connection with this Report.

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REPORT ON THE UNITS

Principal Examiner's Report to Centres G491 Physics in Action

This was the first Physics in Action exam in the new reduced format without section C. It produced a good spread of marks covering nearly the whole range from 0 to 58/60. It was a good discriminator at all levels, although the mean mark expressed as a % was lower than a typical January 2860 Physics in Action paper; it will no doubt rise as candidates adjust to the shorter paper and when they have more past paper material to practise with.

There was much evidence of candidates running short of time, especially weak candidates who often failed to answer most of section B, certainly many candidates left Q 10 and/or 11 blank. Even some of the better candidates did not finish and ran out of time, not attempting the last bits of Q11. Overall, time pressure seemed very acute for many. In the past many candidates had been able to work through section C (worth 30 marks) at more than a mark a minute, hence releasing time for the questions in sections A (straightforward) and particularly B (with more challenging parts).

The weakest candidates showed an immense lack of physics knowledge. With just one term of teaching beyond GCSE it raises the question of whether schools should enter such candidates, who are so clearly unready at this stage.

Qualitative questions were answered much worse than calculations on the whole, but some candidates showed a complete unawareness of the multipliers m, k, M and powers of 10 e.g. use of E^{-3} direct from calculator displays.

Some questions on "newer topics" seemed inaccessible even to good candidates e.g. bits worth dedicating to a signal carrying noise in Q 5 and commenting on experimental uncertainties in Q 9.

Question 9 covered 4 pages and it appeared that some candidates failed to turn back to look at or compare data from earlier in the question. Certainly many seemed to find it novel or difficult to compare and discuss data table values.

Section A:
Q1 This was on electrical units and the majority got at least one with many getting both.

Q2 Was on imaging resolution and many candidates got it correct. The most common errors were: to assume Iapetus filled the whole image, i.e. was 4100 pixels wide; to forget to convert from m to km for final answer. Both of these on their own resulted in one of the two marks lost.

Q3 a This was a new style of question where candidates were asked to draw a line to connect three waveforms to the correct frequency spectrum. Most were correct but there were a number who did not respond. Some joined the peaks, others drew in extra peaks on the spectrum diagrams for no credit.

Q3 b Few candidates could explain why the signals when played sounded at the same pitch. Some talked of same wavelength, same frequency, or that all contain 500Hz but missed the point that they have the same *lowest* frequency component.

Q4 a This was a straightforward resistance calculation for a neon lamp but many missed mA or incorrectly converted mA to A before evaluation, such errors were penalised one of the two marks.

Q4 b This question about the number of electrons passing through the lamp per second gave good discrimination. Better candidates got this correct, but most displayed random calculations based on dividing/multiplying data values from the question. Many gave tiny answers down to 10^{-23} without comment.

Q5 a This question was about the byte rate for a stereo recording. Although targeted as a low-level question it was in fact quite differentiating. Many forgot to double their estimate as it was two channels for stereo, but there was plenty of confusion converting bits to bytes as well.

Q5 b This was one of the questions on "newer topics" and seemed rather inaccessible, with many nil responses. It involved justifying the bits b worth dedicating to a signal carrying noise using: $b = \log_2(V_{total} / V_{noise})$ Most answers just restated the question. Only a few of the best candidates used the equation to come up with 16.6 bits and round down to show that 16 was sufficient. Several good candidates argued from first principles looking at the voltage ratio and using ideas of resolution and comparison to the number of states 2^{bits} (for 16 and/or 17 bits) and gained full credit. The question was a good discriminator.

Q6 a A very straightforward conductance calculation from a given resistance, this question had a high facility but the answer 2.5 (rather than its reciprocal) figured occasionally.

Q6 b Some got (a) correct but then got 7.5 here. It did not seem common knowledge that conductances in parallel add directly like resistors in series. There was e.c.f available here for three times a wrong answer in (a).

Q7 a. Stating how to recognise a logarithmic axis was generally well answered, and even clumsy minimalist expressions such as scale is x 10 were credited.

Q7 b. Here candidates had to describe differences in cost and recycle fraction for glasses and metals & alloys taken from a graph. Over half got it correct but many just quoted figures for some extreme values with no real comparison; others only compared one property. Interestingly candidates were prepared to attempt writing answers at length to this question.

Q7 c. Most seemed to think recycling metal meant reshaping (without melting) and discussed the idea that metals could be hammered or squeezed directly into a new shape, and did not gain credit. Just under a half of candidates answered this question correctly.

Section B:

Q8 a. Candidates were asked to describe differences in pulling material specimens from a stress vs strain graph and there were some good answers. Some seemed to confuse the axes and had the rubber stretching easier than the neoprene, others were too vague and a few compared the wrong materials. Graphs were often misinterpreted and candidates did not describe what they would feel. Many discussed elastic limit, yielding, necking etc. in detail which was not required.

Q8 bi This question on getting a value of Young modulus from the graph was generally well answered. The most common error was to get the wrong power of 10 or ignore the Mega multiplier on the stress axis; however this only dropped 1/3 marks being counted as one error, provided their S.F. were appropriate.

Q8 bii If candidates got bi they tended to get bii and ecf was allowed on the dropped M from bi. Unusually the interpretation of the Young modulus as the local (rather than the initial) gradient of the graph was accepted here for full credit due to the complex nature of the stress strain relationship for elastomers.

Q8 ci A straightforward strain calculation was generally well answered, but a significant minority got 5 as a common wrong answer: (extension / new length rather than extension / original length).

Q8 cii involved an estimate of x-sectional area working from the strain found in ci. The first mark was for reading the correct stress from the appropriate graph (ecf allowed). Then a method mark for area = force / stress and finally an evaluation mark. The facility for this part was about 0.4 so many of the candidates who made an attempt got some credit from the question.

Q9 ai. Here there were very few correct answers; candidates were asked to comment on why an experimental uncertainty in an object distance u could be ignored. Generally they suggested that they were too small to matter or v was the distance of concern. They needed to compare the uncertainty to the value of u (small fractional uncertainty), or to the uncertainty in v (a comparable distance) hence not the most important % uncertainty. Some gained credit by mentioning sensible practical detail that the object is precisely placed at a chosen measured distance from the lens by the student. Some naively stated that this involved no error.

Q9 aii Here candidates were asked to describe the variation in uncertainty from a table of values. To gain credit they had to link increasing uncertainty to the increase in image distance (or decrease in object distance), not merely to the position in the table!

Q9 bi. This tested graphing skills and was generally well done (although few spotted that the gradient should be 1 with the same numerical intercept on each axis). As usual graph point accuracy was judged to nearest small graph square. Most candidates used a rule to plot a good line of best fit with the majority getting 2 or 3 of the available marks.

bii This question on using the graph to get the focal length of the lens was discriminating. Many stated the intercept as being *f* (rather than 1/ *f*). Many candidates tried to use the formula and often got it wrong (signs confused or reciprocals confused). Those that used the intercept were more successful although confusion between power and focal length was still commonplace. Ecf was allowed on incorrect values of power P from the graph.

Q9ci Most candidates recognised that the uncertainties in this part of the question, with new conditions for the lens, had decreased.

Q9cii Candidates were asked to comment on the new conditions for the lens, in this difficult question. Very few got 2 marks, describing only one of the changes. Many failed to appreciate the general physics principles and there were lots of very vague answers using the word “better” for the lens.

Q10ai. A straightforward calculation of atomic volume, which was generally well answered. The most common error was not to half the diameter to find the radius to substitute in the given formula. Some showed the working but did not evaluate it to get a number near the “show that” value given, but could gain 1/2 marks for getting the radius correct.

Q10 aii & aiii. These were simple density calculations and were well answered by about 2/3 of candidates. There were some incredibly wrong evaluations, due to calculations being done mentally rather than by calculator, or by copying the density equation given as the inverse!

Q10 b Candidates had to explain the difference in densities for one atom from part (a) and an illustrated body-centred cubic crystal. Some described why the diagram shown was higher density, rather than the lower density stated in the question. Not many appreciated that the original calculation was for a single atom and here it was for a sample. Descriptions were vague and really did not focus on any physics. Many made a statement and then rewrote the question thereby missing the second mark. Candidates found this a hard question and by now nearly a third of the entry had many question parts with no response.

Q10 c This proved another hard question (as targeted). Candidates were given another crystal structure (face-centred cubic) for iron in diagram form and asked to suggest and explain a possible change in property. There was a wide range of wrong ideas: many thought the iron had melted, ignoring the hint about the change in atomic structure. Those that had got out the density calculations in (b) tended to fare better and discuss the increase in density. But there were convincing answers involving electrical conductivity, stiffness, hardness, strength etc. which could gain full credit for reasoned suggestions.

Q11 This was about the properties and application of a PTC thermistor, whose characteristics were given. The questions were quite well answered by those who hadn't already run out of time.

Q11 ai This involved a potential divider "show that" calculation. There were many good answers, but a substantial number used the approximate 2:1 ratio of the resistors to get the given value 4V exactly. They could only be awarded the method mark.

Q11 aii Most who attempted it, got this straightforward current calculation correct. Several didn't get as far as $I = V / R$.

Q11b. The question asked candidates to state and explain the outcome of a temperature rise on the output from the potential divider circuit. There were many convincing answers, but weaker candidates still in the fray talked of current being used up or voltage lost. Others thought that the current stayed constant and therefore the voltage must remain constant etc.

Q11c Candidates were asked to comment on the suitability of the PTC potential divider in a central heating control or a fire alarm, given its temperature characteristic graph. Few candidates really talked well about sensitivity, and few got the QWC mark, for relating the relevant temperature ranges, perhaps they felt that relating the temperature range to the application was too obvious? Despite the hint given with the QWC mark.

Q11 di Sadly, for the last two questions, over half the candidates made no response. Many of the remainder got the power correct by using $I^2 R$ or equivalent calculation; but there was a variety of wrong evaluations with numbers multiplied or divided seemingly at random.

Q11 dii. For the mark candidates had to link the temperature rise of the thermistor to a rise in its resistance. Some talked about fuses blowing or things being cut off or even frazzled! Others talked about resistance rising but were not specific as to which one, thermistor or fixed, or did not make the link to temperature rise. There was confusion between heat and temperature in many cases, but if they got this far it was not penalised.

Grade Thresholds

Advanced GCE Physics B H159 H559
January 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
G491	Raw	60	39	33	28	23	18	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

No aggregation was available in this session.

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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