OCR
RECOGNISING ACHIEVEMENT

GCSE

Physics A

Twenty First Century Science Suite

General Certificate of Secondary Education **J635**

Reports on the Units

January 2010

J635/R/10J

Oxford Cambridge and RSA Examinations

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

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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GCSE Twenty First Century Science - Physics A (J635)

REPORTS ON THE UNITS

Introduction

For the first time free response questions were included in these examination papers. It was expected that this change would make the papers more challenging for all candidates, and this assumption proved to be correct.

Candidates seem to have been well prepared for the objective style of questioning, but all candidates would benefit from practicing expressing scientific ideas clearly and concisely. For the free response questions many candidates gave vague answers, which were often ambiguous. Waffle and repetition were also common features. However it was pleasing to see nearly all candidates attempting all the open questions.

Despite the increased challenge, there was no evidence of candidates running out of time.

A331/01 – Twenty First Century Science Physics A (P1, P2, P3) Foundation Tier

General Comments

Centres are reminded that this was the first session for A331 in the new format, with around a third of the marks from this paper being awarded on open response type questions. Please refer to the OCR website for further details, including specimen assessment materials.

The paper was well attempted and candidates seem to have been well prepared for the objective style of questioning.

Many candidates seemed less confident when tackling open response questions.

This has resulted in a significantly lower mean mark for the paper than on previous sessions.

Candidates should be aware that the marking is done from scanned images of their scripts. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously.

Any marks that are ambiguous – possibly made with the intention that the examiner could give credit for either of two possible responses, where only one is correct – will not gain credit on this paper.

The level of difficulty was appropriate for the ability range and most questions were accessible to candidates across the ability range. The majority of candidates generally performed well and marks were awarded across a reasonable range, demonstrating satisfactory differentiation.

Scores typically ranged from single figures to the high twenties (out of 42 marks).

Most candidates correctly followed the instructions in the questions and most made their responses appropriate to the number of marks available. Some, however, did not read the questions carefully enough.

All candidates seemed to have made good use of their time. There was no evidence of candidates running out of time.

Comments on Individual Questions

1 Most candidates knew the relative ages required in part (b), but a significant number of weaker candidates struggled to sort the Earth, Sun and Milky Way by size in part (a).

2 Only the most able candidates scored full marks on this question. The majority of candidates could correctly identify the second answer as ‘galaxy’, and a large minority also identified ‘star’ correctly as the first answer. The final answer was often incorrectly given as ‘white dwarf’, with weaker candidates selecting ‘star’ as their third answer. These candidates often gave ‘cloud of gas’ as their first answer.

3 Most candidates coped well when asked to identify data and explanation in the four statements for part (a) of this question. Part (b) was the first open response question on this paper as part of the change in format this series. This part was very poorly answered by almost all candidates. Candidates were rewarded if they could demonstrate a clear appreciation of how repetition of results would improve reliability. Just mentioning 'not enough data' was insufficient as a response. Many candidates did not address the question, instead attempting a discussion on the interest of fellow astronomers in the work.

4 Part (a) of this question asked the candidates to select statements from a list to explain why mountains must be forming all the time. Very few candidates scored full marks here. The most common wrong answer was statement F 'Mountains only form on drifting continents. In part (b) the vast majority of candidates selected the jigsaw-fit idea, possibly recognising it as something they recalled from lessons. Teachers are asked to remind students that irrelevant but true statements can be included as distracters from the correct answer.

5 It was pleasing to see that almost all candidates could successfully identify the correlation required in part (a)(i). In contrast the responses to part (a)(ii) on the whole failed to address the question satisfactorily. Where bullet pointed guidance to structuring of an answer is given, candidates should be advised to address each point clearly in their answers. Many candidates merely repeated the information already given in the stem of the question, ie "The U.V. radiation burnt the boy". The rest of part (a) was very well tackled by candidates.

The main problem for candidates on part (b) seems to be due to weaker candidates misinterpreting the instruction to identify the part of the spectrum labelled E on the diagram. Many weaker candidates left this question blank. Part (c) was well answered, with carbon dioxide being the most common incorrect choice.

6 This question asked the candidates to use a simplified version of the carbon cycle to discuss the effect of burning trees on levels of atmospheric CO_2. Only the most able candidates scored here. The majority of weaker candidates presented answers involving the whole carbon cycle. A number of these candidates discussed how plants and animals would form fossil fuels which when burnt in the power stations would release CO_2. Answers involving trees 'breathing in' CO_2 were also commonplace. Most candidates could suggest at least one way of reducing the risk of global warming in part (b), with common answers including reduced car travel and ideas about recycling and reducing consumption of energy in the home.

7 Part (a) of this question asked candidates to interpret graphical data showing the activity of three different radioactive sources over time. This question proved to be a good discriminator across the ability range. In part (b) all but the weakest candidates managed to pick up marks. A small majority of candidates identified the possibility of being free from cancer for a mark in part (b)(ii) and many went on to say that there was the associated risk of developing new cancers as a result of the treatment. For a 3 mark question however, all but the most able candidates produced answers that were either too brief or repeated the same point again. Most candidates scored well on part (c), but surprisingly few were able to identify both Sue and Tim as talking about risk. Perhaps this is because risk is often presented as a negative comment rather than Sue's statement of steps taken to make the treatment safer.

8 This question showing the standard block diagram approach to describing the key components of a coal-fired power station was poorly tackled by the vast majority of candidates. The most common correct answer was ‘generator’, followed by a much smaller proportion that got ‘turbine’. Very few candidates identified the first stage correctly as ‘furnace’ or ‘boiler’. Weaker candidates tended to leave this question blank, with some attempting to describe the processes occurring rather than naming the components.

A331/02 – Twenty First Century Science Physics A (P1, P2, P3) Higher Tier

General Comments

Generally candidates performed well on the paper. Only a few candidates were inappropriately entered for this higher tier paper. Approximately half the marks on the higher tier paper are targeted at grade C/D.

The introduction of free response questions in this paper resulted in the mean mark being significantly less than in the previous papers. Weaker candidates were affected the most. All candidates would benefit from practicing expressing scientific ideas clearly and concisely. Many candidates gave vague answers, which were often ambiguous. Waffle and repetition were also common features. However it was pleasing to see nearly all candidates attempting all the open questions.

Comments on Individual Questions

1 This question was clearly thought out by many candidates. In part (a) mountains only being formed on drifting continents was the most common error. In part (b) many candidates chose the jig-saw fit of continents, a relevant true statement, but not one that answered the question.

2 In part (a) most candidates recognised the age of the Sun and the Universe; fewer knew the age of the Earth or its oldest rocks. A common error was to suggest the Sun's diameter was 1000 times the Earth's diameter.
Part (b) was generally answered well. In both sections the most common error was planets being discovered around nearby stars.

3 Many candidates appeared to have a reasonably good idea about the concepts involved but many had great difficulty in expressing them clearly and concisely. Quite a few conflated the ideas of "Peer Review" and "Replication" but weren't necessarily penalised for that if they demonstrated a full understanding. For those penalised one or two marks, a common mistake was to interpret "Replicated" as "copied" in the sense of plagiarism and attribution of the discovery.

4 The most commonly scored mark in part (a) was the idea that reduced photosynthesis meant less CO_2 removed from the atmosphere. The production of CO_2 from combustion of the trees was also common, although many weaker candidates got confused over fossil fuels producing CO_2. A significant minority of candidates failed to explicitly state what happened to levels of CO_2 in the atmosphere. In part (b) nearly all candidates were able suggest correct ways of reducing CO_2 emissions. Nevertheless, a few candidates lost marks through references to animals or waste rotting, and catalytic converters.

5 In part (a) few candidates correctly identified the correlation in the article, between exposure time and burns. Most candidates linked the sunbed/ultraviolet to cancer, which was not a correlation given in the article, however one mark was allowed for recalling this link. Part (b) was answered well by most candidates. The most common error was to think that cancer was due to the heating effect of the ultraviolet.
Few candidates gave a clear correct explanation to gain two marks in part (c). Some candidates achieved one mark because they were able to express at least something of

the idea of inadequate evidence, one-off example or non-compliance with instructions. Nevertheless many candidates received no marks. Common themes in these cases were the absence of benefits vs risk, references to it being based on the Precautionary Principle and no application of ALARA.

6 This question proved challenging to most candidates. In part (a) few knew that ozone absorbed ultraviolet, with CO_2 being the most common error. More candidates knew that the ultraviolet caused chemical reactions in the atmosphere, but many candidates thought it produced photons. In part (b) CO_2 was the most common correct answer, but usually paired with an incorrect oxygen, hydrogen or nitrogen.

7 Candidates did not perform well on this question. Many correctly labelled a furnace/boiler/steam producer. However there seemed to be a genuine confusion in several candidates' mind about turbine and generator with many answers implying that they were one and the same thing. Weaker candidates simply referred to fire and steam, with no indication that they understood the processes. The best answers were produced by candidates who had clearly learnt a form of the diagram and reproduced it with confidence.

8 Part (a) was generally answered well. In section (i) the most common errors were the inverses ie in (i) C the longest half-life, in (ii) D the least active and in (iii) A and C the most likely to be a storage problem. Few candidates could identify the background radiation, with a wide range of incorrect values given.

In parts (c) to (e) candidates generally demonstrated a good grasp of the risk issues associated with radioactive sources. Most candidates scored at least one mark in part (f). However many ignored the information given and just put one of alpha, one of beta and one of gamma. An instruction that answers may be used more than once usually implies they are used more than once.

A332/01 – Twenty First Century Science Physics A (P4, P5, P6) Foundation Tier

General Comments

Generally candidates performed well on the paper. Very few candidates were inappropriately entered for this foundation tier paper.

There was no evidence of candidates having any time problems, with nearly all papers having some attempt made at some parts of all questions.

The introduction of free response questions in this paper resulted in the mean mark being significantly less than in the previous papers. Weaker candidates were affected the most and often did not even attempt the free response questions. These weaker candidates should be encouraged to make an attempt, many score marks when they do. All candidates would benefit from practicing expressing scientific ideas clearly and concisely. Many candidates gave vague answers, which were often ambiguous. Waffle and repetition were also common features.

Comments on Individual Questions

1 Part (a) - most candidates answered these correctly, although a few candidates multiplied the two distances.

Part (b) section (i) was correctly answered by most candidates. In section (ii) a significant number of candidates did not attempt this question. Of those candidates who did attempt the question, most scored the mark. A large number of candidates did not extend the line back to the axis, this was not penalised on this occasion. A few candidates drew lines back towards the origin, misunderstanding distance-time graphs.

Part (c) produced a very varied response. Although some candidates picked up marks, often this was for describing the speeds on the three types of road. Others misunderstood the graph completely, suggesting that the changes in velocity in C and D were curves in the road. A large number of candidates suggested the lorry stopped in part D. A small number of candidates described the graph as waves, using the language of wavelength and amplitude.

2 In part (a) most candidates picked up a mark for “boosters must be doing work”. The errors here showed little in the way of patterns, although a significant number wrote “potential energy” instead of “kinetic energy”.

In part (b) a significant number of students appeared to try to do a calculation. The common incorrect answers were 4 or 16. Some wrote a number such as 7.9, suggesting an understanding of energy losses, without understanding the question. Section (ii) was very poorly answered, showing little understanding of the processes of energy loss, or of the transference of GPE into KE.

3 In part (a) a significant proportion of candidates seemed to believe that electrons are positive.

In part (b) candidates tended to misunderstand the inverse relationship between current and resistance, with a large number stating that the lowest resistance would have the lowest current. A small number of candidates wrote down Ohm's law in the margin; those candidates tended to get the answer correct.
Few candidates knew how resistors added in series and parallel. Some gave the answers the wrong way round, but many thought it made no difference.
Poor use of scientific language lost many candidates marks, for example, a large number wrote that electricity flowed through the resistors in section (iv).
In section (v) Many candidates misunderstand the question, and wrote about the uses of a thermistor (eg "the thermistor turns off the TV when it gets hot"). Of those who did understand the question, few knew the inverse relationship between resistance and temperature.

In part (c) most candidates chose either the correct answer, or the first distracter, which did not covert the power into kW.

Part (d) was answered correctly by most candidates. The most common error was 'large'.

4 In part (a) few candidates showed any secure knowledge of induction. Marks were low on all sections with little in the way of patterns of wrong answers.

The most commonly scored mark in part (b) was for the idea that the magnet moved. Many candidates talked about charge being produced, or talked about charge moving from the magnet to the coil of wire.

In part (c) many candidates mixed up direct and alternating current. A significant minority thought that mains voltage supply is 110V.

5 Parts (a) and (b) were answered correctly by the majority of candidates.

Many candidates answered part (c) correctly. There was no obvious pattern in the incorrect answers.

In part (d) the most common correct response was "photons travel at the speed of light". The incorrect answers were chosen equally regularly.

In part (e) most candidates picked up a mark for linking radio waves - atmosphere, but the microwaves and infra red were frequently confused.

In part (f) the most popular distracter was C.

6 Many candidates did not attempt part (a). Of those who gave correct answers, a few were very close to losing marks for poor diagrams (particularly of digital signals). A common error was describing the differences in their uses or properties (eg ability to remove noise).

Part (b) was answered well. Of those who did not get three marks, most picked up a mark for "quality". The most common error was to mix up digital and analogue.

A332/02 – Twenty First Century Science Physics A (P4, P5, P6) Higher Tier

General Comments

This paper is designed for candidates operating in A* - D range.

This paper showed a major change to past papers in that approximately one third of the marks were awarded for 'free response' answers in which candidates had to write their own responses as opposed to the more 'objective' type questions of the past. There was definite evidence that some candidates were unprepared for this type of question and consequently scored very poorly on some of these questions. There were a significant minority of candidates scored zero, one or two marks out of fourteen on these questions, with a few candidates giving no response whatsoever to any of the questions.

There was no evidence of candidates having time difficulties with the vast majority completing all questions in the time allowed.

Candidates should be aware that the marking is done from scanned images of their scripts. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously. Any marks that are ambiguous – possibly made with the intention that the examiner could give credit to either of two possible responses, where only one is correct – will not gain credit.

Comments on Individual Questions

1 Part (a) produced some rather disappointing responses with a significant minority of candidates only circling the' 10m/s south' velocity and not the' –10m/s north' even though they were asked to circle two velocities.

Part (b) produced much better answers with the majority scoring all three marks. Good answers identified the speed in all three sections and also talked concisely about changes in speed. When candidates scored zero marks it was almost always because they failed to answer the question, giving a general account of the type of information that could be gathered from speed-time graphs or tachographs, but ignored the graph in the question. The most common mark that was lost by a candidate was for section C, the town. Poor answers focussed on the frequent changes in speed but failed to realise that stopping and starting was involved or failed to explicitly state this, although references to traffic lights were common. Candidates who did not describe the 'main road' section usually disqualified an otherwise good response through stating that the lorry stopped.

2 Almost all candidates identified the first box as correct and a large number also correctly selected the third box, but a considerable number then went on to select the last box (force/time = change in momentum) and hence lost a mark.

3 Over 60% of candidates knew that air bags increase the time for momentum to be lost, unfortunately nearly all those who got this question wrong identified that air bags change the momentum occurring in the collision. This response, together with common errors in the previous question, suggests that the concept of momentum is poorly understood.

4 This question proved to be highly discriminating between weak and strong candidates. There were some excellent answers that allowed the candidates working to be followed. Weaker candidates often only scored a mark for calculating the potential energy lost to be 8000J. Many lost that mark because they did not state that the 8000J was in fact P.E., or wrongly identified mass for weight and stated P.E. = 800J. Another common error was to correctly identify P.E. lost equalled K.E. gained, calculated the P.E. as 8000J and then correctly wrote 0.5x80x20x20=8000 but then gave the answer as 8000.

5 In part (a) the majority identified weight with gravitational force but the most common error was to link weight with height x GPE.

Part (b) was very poorly answered, with the most common mistake being to identify work done with height x GPE.

Part (c) was better answered with no common mistakes.

6 Part (a) was well answered with only a very few candidates gaining no marks, although a minority did incorrectly link metallic conductors with positive or negative charge flowing and electric currents having many charges that are free to move.

Part (b) proved very difficult. In section (i) many candidates identified the parallel circuit as having the smallest current. In section (ii) the best answers were logical and only addressed circuits B and C. They stated that the voltage was the same in both circuits and then simply stated that the resistance of C was smaller than B. Some of the very best candidates could then explain this in terms of combinations of resistors. Common terms were, 'in parallel there are more paths for current', 'in series resistors add up' although some failed to score here due to a failure to appreciate that resistors and resistance were separate things. Many candidates gave the answer to section (i) as 'B A', but were then able to gain full marks in section (ii), although some then devoted their efforts to explaining why 'C' was not in the answer and inevitably shot themselves in the foot. Some weaker candidates showed a lack of knowledge of circuit diagrams and mistook resistors for cells. There were a considerable number of candidates who used the idea that the current had to be shared in a parallel circuit to justify giving C as the circuit with the smallest current – probably using the logic that if you share things out then everyone gets less. Voltage was very often ignored.

Part (c) section (i) simply required the answer 'a current flows' but there were many more complex answers in terms of electron collisions etc. Weaker candidates said that' voltage flows through the resistors' or that 'charges built up in the resistors'.
Section (ii) produced many good answers along the lines of 'as the temperature increases the resistance decreases'. Most candidates who scored zero gave a greater/greater relationship. Many candidates talked about heat rather than temperature and, although this grated, it did not preclude the mark being given. Some weak candidates gave the response 'It increase,' or 'It decreased' without relating temperature with resistance and others wrote about current flow rather than resistance.

On the whole part (d) was well answered (although 500 x 4p was a common wrong response) as was part (e).

Part (f) was poorly answered. In section (i) all but the best candidates failed to score, with common incorrect response including 2J and 6J. For section (ii), many candidates had the idea that collisions occurred, but answers were vague about what was colliding with what. Some response stated electrons collided with electrons or with the sides of the resistor. Few candidates received the mark for collisions causing the atoms to vibrate, many candidates going from the idea of collisions to heat transfer. Ideas of friction and frictional

heating were common and good number of candidates spoke of the ‘atoms moving’ or the ‘atoms colliding with each other’

7 As questions on electromagnetism inevitably do, this question proved highly discriminating. Most candidates scored some marks here. By far the most common reason for the award of zero marks was when candidates did not comply with the instructions and only ticked boxes, neglecting to use crosses. Many candidates attempted to change crosses into ticks and vice versa. In these cases it was often difficult to determine exactly what the candidate had intended as their response.

8 In part (a) section (i) the best candidates provided a concise answer stating that the digital had only two values and analogue could have any value, coupled with accurate labelled diagrams of both. Poorer answers were couched in terms of analogue being harder to remove noise from (perhaps this came about by candidates reading the next question and then back tracking) but in many of these cases the answers were accompanied with diagrams that could be credited. The most common error in diagrams for digital signals was where the signal had a series of different heights in the waveform and this clearly contradicted a statement that digital was a series of 0’s and 1’s.

In section (ii) many candidates scored full marks. When candidates failed to score fully the most frequent error was on the first missing word, where the most common mistake was to select ‘frequency’.

The majority of candidates gained the mark in section (iii), and there was no discernable pattern to incorrect responses.

In part (b) the majority gained this mark but the most common error given was that all electromagnetic waves have the same frequency.

In part (c) many candidates received one mark for correctly identifying that intensity depends on number of photons per second showing an appreciation of the photon model of light, however many candidates then identified the greater energy of a photon with a greater speed and ignored the speed of light.

9 For part (a), the most common error was to select the ’light travels too fast’ box.

A common error in part (b) was to connect ‘quiet’ to ‘no interference’ to ‘out of step’.

Part (c) was well answered, with 600/300 being the most common error.

Grade Thresholds

General Certificate of Secondary Education
Physics A (J635)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A331/01	Raw	42				23	18	14	10	6	0
	UMS	34				30	25	20	15	10	0
A331/02	Raw	42	30	25	20	16	10	7			0
	UMS	50	45	40	35	30	25	20			0
A332/01	Raw	42				22	18	15	12	9	0
	UMS	34				30	25	20	15	10	0
A332/02	Raw	42	31	25	19	14	10	8			0
	UMS	50	45	40	35	30	25	20			0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J635	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J635	0.0	66.7	66.7	66.7	100.0	100.0	100.0	100.0	100.0	3

66 candidates were entered for aggregation this series

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

Statistics are correct at the time of publication.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

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Facsimile: 01223 552553