

**Physics A**

**Twenty First Century Science Suite**

**General Certificate of Secondary Education J635**

**Examiners' Reports**

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**January 2011**

**J635/R/11J**

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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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## **Chief Examiner's Report**

The number of candidates entered for the Physics A specification has continued to grow this session.

It has been a pleasure to see the performance of candidates in this assessment session. As hoped the inclusion of more extended prose questions has provided candidates with more opportunities to demonstrate what they know. However a few candidates lose a lot of marks when they do not attempt these questions.

It is clear that in general centres have done a good job in preparing candidates for this style of paper, with most candidates now familiar with the different styles of question. However one issue has been raised by examiners as becoming more prevalent. This is the legibility of candidates' handwriting. More candidates are losing marks because the examiner is unable to decipher what the candidate has written. This is the case on both higher and foundation tiers.

Examiners have noticed some issues arising with calculations. There was evidence of some candidates not having access to electronic calculators in the examinations, candidates are at a significant disadvantage in such circumstances. Question setters will assume that candidates have calculators. Some candidates do not appear to be aware of the formulae provided at the front of the examination paper and consequently struggled with calculations.

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

### General Comments:

This paper is designed for candidates operating in C – G grade range.

Two thirds of the marks on this paper were awarded to objective type questions and one third of the marks were awarded for 'free response' answers in which candidates had to write their own responses. In general candidates performed better on the objective type questions.

There was no evidence of candidates having time difficulties with the vast majority completing all questions in the time allowed. It was also clear that the vast majority of candidates were entered for the correct level paper

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.

Another point that Centres should consider is that candidates should be encouraged to give an answer especially with the 'tick box' type of question. Failure to read the question as to how many ticks were required also caused problems for some candidates.

### Comments on Individual Questions:

#### Question No.

- 1(a)** Most candidates appeared to get this wrong with 'the fuel is burnt,' being the most common distraction.
- 1(b)(i)** Radiation was often given as the first part of the answer but 'active' and 'half-life' were frequently omitted. Many found the third answer tricky choosing water or protons in rather large numbers. Generally it was only the candidates who scored the very highest marks overall who gained all the marks in this question.
- 1(b)(ii)** This question appeared to cause some confusion with every combination of boxes connected and no real trend of misunderstanding, many thought low level waste went down the sink.. Several candidates lost marks because they drew two lines from a left hand box. Some candidates failed to join the boxes and this could perhaps be looked at by Centres, in most cases this did not result in a loss of marks.
- 1(c)** Many candidates did not read this question properly and either thought it was still about radioactive waste or burning fossil fuels, frequent alternative ideas were to do with carbon dioxide, global warming, pollution of the sea, killing fish and to reduce the risk by using a different fuel or energy source. Despite this, most candidates did try to answer the 3 sections.
- 2(a)(i)** It was very rare to see the correct percentage calculated for 'dental' and there was considerable evidence of lack of calculators or inability to use a calculator properly. It was good to see that virtually all calculations, whether correct or incorrect, went to the correct decimal place.

- 2(a)(ii)** Most got the correct answer but some still came up with 'nuclear power' even when their dental answer was too big, the error carried forward from (i) helped some candidates. 'Medical' often appeared as an answer.
- 2(b)** A pleasing number of candidates had the idea of higher pay and/or a social reason. Only one or two candidates mentioned "benefit" and "risk". Most that scored cited more pay and desire to help/desire to do the job for the marks. Some candidates misinterpreted the question and answered in terms of why people may want to get cancer or by saying they might already have cancer
- 3(a)(i) – (iv)** This question seemed to sort out those who knew their electromagnetic spectrum from the guessers quite well, with many scoring all four marks, although every possible answer appeared. A pleasing number had gamma for last part although microwaves or visible light were common errors for iii. There was evidence of some candidates feeling they could not reuse types in these answers. On a few occasions "gamma" was crossed out at (iii) and replaced with something else and then "gamma" given at iv, suggesting candidates may have altered iii after doing iv.
- 3(b)** Quite a few candidates managed one of the marks here. There was evidence of some candidates not reading the question as only ONE box ticked. 'Split the cells' and 'poison them' were popular distracters.
- 4(a)** This question had a deceptively easy looking diagram, but most only scored 1 or 2 marks, rarely all 3. Photosynthesis was often correct although the poor giraffe was often decomposed and the tree burned.
- 4(b)** The vast majority of candidates managed to choose correctly here.
- 5** Many candidates did not know what was being asked for in this light to sight question.
- Some re-ordered the stem of the question as an answer, some thought it was about absorbers and transmitters of light or nuclear radiation and some tried to explain how they themselves just looked at the paper. . A minority answered in terms of radioactivity using alpha or beta radiation. A common mistake was using UV to see not light. If the light source was mentioned at all the most common error was to say that the source travelled rather than light. Candidates often failed to distinguish between light as a source and light as the energy. A worryingly large number of candidates had light being reflected from or coming out from their eyes to see the paper. Many pupils did not refer to the eye at all just using the words from the diagram. When 3 marks were gained the missed mark was usually that of the eye being the detector.
- 6** For most candidates this was a question in which they scored full marks with the order of the three words being the only problem. Occasionally some candidates included nucleus in place of core.
- 7(a)** Answers here suggested a large number of candidates failed to read the question since the most common answer was a pretty star shaped pattern of three lines. Very few scored two marks. Fewer than expected actually managed to follow the instruction and draw just one line.
- 7(b)** The age of the universe was often correct but distances to galaxies was often incorrect. Some candidates only gave one tick which automatically reduced their mark for this question.

- 7(c)** Most knew about the Universe being everything and a few knew about stars but it was rare to see a three mark answer. This proved a good question to show up individual misconceptions, of which there were many. A considerable number candidates considered that stars were on fire or were burning. Many confused planets and stars. Correct answers often used '...a star is like our sun...' comparison. A very small number had the idea of nuclear fusion or answered the question in a way expected on higher tier. Very few had the correct idea of scale for the galaxy mark ie that a galaxy contains many/millions/massive numbers of stars. A number referred to the Universe as being '...all the world.'
- 8(a) and (b)** These questions were mostly well done but 'the sea floor,' in (a) and 'continents fitting together,' in (b) were distractors.
- 8(c)** Some candidates had clearly heard about building design in countries which have frequent earthquakes but there was a popular misconception that governments actually go out and physically build earthquake proof buildings rather than bring in building regulations that required such safety features. Another popular misconception was the idea of an early warning system and evacuation before earthquakes. A significant minority incorrectly answered in terms of global warming being the problem, or we should encourage recycling, or use fewer cars!

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

### General Comments:

Generally candidates performed well on this paper. However there was an increase in the number of candidates who had difficulty accessing the questions and as a consequence performed badly. This suggests that some candidates may be being entered for the higher tier, for whom the foundation tier would be more appropriate.

The majority of candidates made a good attempt at the paper, with nearly all candidates attempting most questions, although some very weak candidates left many parts blank. There was no evidence of candidates running out of time

In general the candidates coped reasonably well with the extended prose questions. However for a significant minority the quality of the handwriting verged on the illegible.

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.

There was evidence of some candidates not having access to electronic calculators in this exam. Candidates should be made aware that they are at a significant disadvantage in such circumstances.

### Comments on Individual Questions

- 1 (a) (i) Most candidates appreciated the need to quote the answer to the precision of the given numbers and hence the most likely source of error was truncation of the answer rather than correct rounding. A small number of candidates gave the answer as 0.01% indicating that they had reversed the division sum. Some candidates did not seem to have access to a calculator and made an attempt to estimate the answer based on the figures quoted for nuclear power which had roughly half the number of people.
- (ii) Was answered well by most candidates. Medical was probably the most common incorrect response.
- (b) There were many good answers that clearly stated that the 'benefits outweighed the risks'. Greater pay was by far the most common benefit identified but a significant number of candidates gave responses in terms of helping others or enjoyment of the job. Many responses that did not score both marks referred to that fact that the risks were small or that the employer would take added precautions. Some candidates answered along these lines in terms of ALARA.
- 2 (a) Most candidates were able to give a correct statement of the ALARA principle. Most candidates attempted to identify a risk, but few answers showed a detailed understanding. A significant number of weaker candidates considered that the submarine could blow up with some even referring to nuclear explosions. Radiation, leaks and contamination were often referred to without any detail. The third marking point, required detail of how the ALARA principle could be applied to this situation. Many candidates attempted answers in terms of protective clothing, smaller reactors or using the submarine for less time. Few explained how these measures would protect the occupant or reduce the risk to occupants.



- (b) (i) The most common incorrect response by far was A showing that candidates did not appreciate the exponential nature of radioactive decay.
- (ii) Well answered. 18 MBq was the most common incorrect response.
- (iii) Unsurprisingly this was not answered nearly as well as previous question. There was a wide range of wrong answers given. 4 years was the most common error. 12 years was certainly the least common error.
- (c) This was answered correctly by most candidates. The most common wrong answer was D followed closely by A & B.
- 3** There were some excellent concise answers given. These scored full marks within 3 lines of response. The most common omission was a statement about light travelling/being transmitted. However the question clearly showed major areas of misconception on the part of many candidates and a significant number of candidates lost marks due to poor use of language implying that light sources travelled. A common error was for candidates to identify the examination paper as the source of the radiation. Other errors included saying that light entered the eye, but failing to identify the eyes as the radiation detectors and giving light as the radiation source. However the most common misconception was that light entered the eye and then was reflected onto the paper.
- 4** (a) Although generally answered well, mistakes were common on all three statements. The most common mistake was on the last statement with 'size' being by far the most common incorrect response. Mistakes on statements one and two were only slightly less common than on statement three. With statement two, 'size' was again the most common incorrect response.
- (b) Most candidates answered correctly. The most common mistake by far was the 30,000,000 km/s box. Showing that candidates had recalled the number given for  $c$ , but had failed to appreciate the importance of units.
- 5** (a) Incorrect responses to this question were split fairly evenly between the 1<sup>st</sup> and 3<sup>rd</sup> statements. Very few candidates incorrectly selected the 4<sup>th</sup> statement.
- (b) Many candidates were correctly able to select statements one and three. Selecting statement seven, about CFCs, instead of statement six was very common error.
- (c) A very poorly answered question. Many candidates totally failed to appreciate what the question was asking them to do and concentrated on aspects of how global warming could be minimised. Many candidates that did appreciate the thrust of the question gave weak answers which invariably centred on the terms "better safe than sorry". These candidates tended to see the principle as something to use when an action was thought to be a risk, rather than the concept of an unknown risk.

- 6** The most common error here was that candidates did not appreciate that visible light 'heats up cells' and 'increases vibrations of molecules'. Almost all candidates were able to correctly identify that only light was used in photosynthesis. Some candidates seemed unwilling to leave a row with no ticks.
- 7** (a) Nearly all candidates correctly identified the edge of tectonic plates
- (b) Again very well answered by most candidates.
- (c) Most candidates understood what the question required, but responses often failed to gain the first mark because direct building action, rather than regulation, was specified as the Government action. Another very common error was to expect Governments to predict earthquakes. Governments removing populations from tectonically active areas was another common mistake.
- 8** This question was aimed at high demand. The specification content was expressed as a mathematical formula. Requiring candidates to apply their knowledge and mathematical skills in a novel context. More able candidates performed well on the question, with part (b) being most challenging and part (c) the least demanding.
- (a) Common errors included "the number of planets", "the numbers of galaxies", "the number of moons".
- (b) Most candidates correctly ringed 'p'. 'S' was the most common incorrect response selected. This may have been related to recent announcements in the press of the discovery of multi planet solar systems.
- (c) Most candidates realised that the Earth was the only planet we know has life on it.
- (d) Many candidates seemed to interpret the question to be asking for what evidence has been found that life could be on other planets, with answers about 'water' or 'correct atmosphere', being common responses. Many answers seemed to be based on the idea of the possibility of simple singled celled organisms existing elsewhere in our solar system, with Mars often being quoted. Some answers referred to the 'microbe fossils' found in a Martian meteorite and now dismissed by the scientific community.
- 9** (a) Many candidates failed to appreciate that this question was about scientific reliability and were distracted into giving answers about cosmology. The last statement was the most commonly selected wrong response.
- (b) The 4<sup>th</sup> calculation, which missed the number of days in a week, was the most commonly selected incorrect response.
- 10** (a) Response A was just about the most common wrong response, showing that candidates understood the symmetrical nature of the patterns caused by seafloor spreading, but failed to appreciate the significance of the type of crust involved

- (b) Most candidates answered this correctly There was no clear pattern to the incorrect responses.

## 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.

In general better attempts were made by candidates to answer the free response questions this session. Weaker candidates were still affected the most and often did not 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 practising expressing scientific ideas clearly and concisely. Many candidates gave vague answers, which were often ambiguous. Waffle and repetition were also common features.

There was evidence of some candidates not having access to electronic calculators in this exam. Candidates should be made aware that they are at a significant disadvantage in such circumstances.

### Comments on Individual Questions

- 1 (a) Most candidates answered these correctly.
- (i) Most common correct response was in the 'vehicle stopped...' row. The vast number of incorrect ticks were either 'moving up tower = decreases and moving down = increases' or they seemed to think that any movement meant an increase in GPE – possibly confusing with KE.
- (ii) Most common incorrect response was 'magnetic'
- (b) A variety of incorrect responses but the most common was 800,000KJ calculating correct number but failing to carry out the unit change.
- (c) i) Very little evidence that candidates understand the principle of conservation of energy, with all three answers being equally common. ii) Most candidates answered this correctly. The most common incorrect response was 'it gets faster as it falls'
- 2 (a) Most correctly chose 5m/s. But there was evidence that a significant proportion of candidates did not have calculators
- (b) A majority of candidates correctly answered this. The most common incorrect response was 'C' – perhaps learned that a horizontal line on a velocity-time graph represents constant velocity
- (c) Most candidates answered this correctly. The most common incorrect responses were 'B' and 'C' fairly even mix of those who recognised that the graph should be horizontal but incorrectly chose B and those who recognised the need for a negative value of V but incorrectly chose C.

- 3 (a) The most common correct response was quoting a correct formula. Many went on to explain this e.g. 'Momentum = mass x velocity..... so you times the dummy's mass by its velocity' BUT they didn't refer to taking measurements. Other errors included: many incorrect references to the airbag 'measure the speed of the airbag' etc., many 'take the mass of the CAR'. A few candidates used change in momentum = Ft. In this instance this was accepted as an alternative correct method.
- (b) (i) Most candidates did well on this. The most common mistake was to not recognise that it is an inverse relationship. So many of 'decrease, decrease' i.e. the time increases therefore the force increases.  
(ii) Nearly all candidates answered this correctly
- 4 (a) Many candidates are still under the impression that any metal is magnetic. The most common incorrect response was 'copper'
- (b) (i) This is simple recall and only just over half correctly remembered 230V. The most common incorrect response was 50V  
(ii) Candidates were not clear about ac and dc, with most incorrect responses being dc.
- (c) This was generally well answered with the most common errors being the reversal of statements **B** and **C** or **A** and **D**.
- 5 (a) Few candidates were familiar with the LDR, It was very surprising how few could identify the link with light. The most common correct response was in linking LDR detecting and current flow. Next was 'detects light'. Not many mentioned changing resistance and even fewer how more light means less resistance.
- (b) Many candidates correctly found the resistance. Again there was evidence that a significant proportion of candidates did not have calculators.
- (c) Most candidates scored well on this part. The most common correct response was 'the battery pushes.... = true'. The most common incorrect response was 'the total resistance.... = true'
- (d) Most candidates answered this correctly
- 6 (a) Just under half of candidates answered this correctly. The most common incorrect response was 'longitudinal'
- (b) A majority of candidates answered this correctly there was no pattern apparent in the choice of incorrect answers.
- (c) Candidates found this the hardest part. A significant proportion incorrectly picked voltage
- (d) (i) most candidates recognised that A was reflection but the most common incorrect response was refraction = B

(ii) This proved very challenging. The most common correct responses were with reference to what changes i.e. direction, wavelength and speed. Many repeated the stem of the question 'different angles', which scored no marks. Far fewer could identify what remained the same, with both speed and wavelength common errors.

- 7** (a) This was answered well by most candidates. Many candidates chose 3 out of 4 correctly – with the last choice incorrect.
- (b) This was answered well by candidates. The most common incorrect response was 'digital signals change frequency.'
- (c) Only About half the candidates got correct identified the digital signal, which was disappointing. The incorrect answers divided fairly equally between the distracters.
- 8** This was poorly done by candidates. Very few of whom recognised the situation as diffraction, commonly not giving it any name. When the diagrams were completed it was most commonly to just continue the wave fronts on the right hand side of the diagrams. Quite a few candidates had clearly seen this experiment done with ripple tanks and often gained a mark for curved waves on the right hand side.

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

## General Comments

The paper was well attempted and produced a good spread of marks. Candidates seem to have been well prepared for the objective style of questioning. Some candidates seemed significantly less confident when tackling open response questions.

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 the around ten to the low thirties (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.

A significant number of candidates did not seem to make use of the formulae provided at the front of the examination paper and consequently struggled with calculations.

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 All but the weakest candidates picked up marks on part (a) of this question. There was a lack of detail from many candidates in (a) (i), with many not going on to mention the transfer from PE to KE as the ride falls.

The vast majority of candidates did not pick up on the need to convert the value to kJ to get the correct answer in part (b), thus 800 000 kJ was the most common answer. These candidates could still pick up a mark in part (c) (i) by stating the same value as their answer to part (b). Good candidates picked up on the idea of energy wasted due to resistive forces acting in the final part of this question. Weaker candidates answered in terms of the ride having stopped already or simply offered no answer.

- 2 Most candidates coped well with this question. Parts (a) and (b) demonstrated that a large majority of candidates could interpret motion graphs correctly as even weaker candidates did well here. Most candidates identified 'the weight decreases' as a correct explanation in part (c), but then most seemed to have a stab in the dark as to a second correct statement. Part (d) on interaction pairs was very poorly answered as is often the case with this topic, with the majority of candidates selecting Peter instead of Nigel. It is possible that candidates did not pick up on the fact that the **incorrect** statement was required as the answer here.

- 3 This question differentiated well in terms of ability. An average candidate picked up 1 mark in this question, usually for recognising the increased duration of the impact as a result of using an airbag in part (b) of the question. A significant number of candidates failed to secure the second mark in the free response question as a result of suggesting/stating that this resulted in a smaller change in momentum, therefore less force.
- 4 This novel context for a transformer question did not seem to phase candidates. Most candidates picked up at least 2 marks in the sequencing activity in part (a). A surprising number of lower ability candidates could not recall the UK mains supply in part (b). The calculation in part (c) proved inaccessible to all but the most able candidates. Typically candidates either scored all 3 marks or they scored 0 marks on this part of the question. Candidates should be encouraged to show all of their working out clearly, to make it possible to award partial marks for incomplete/ incorrect calculations.
- 5 This question on electric circuits produced a reasonable spread of marks. Only more able candidates could successfully identify the component in part (a) as an LDR **and** select the correct symbol to match. Part (b) caused few problems for most, but part (c) (i) was only well answered by the more able. 5A and 45A were more commonly seen as an answer from low performing candidates. In (c) (ii) the vast majority of candidates could identify circuit C as giving a larger current, but very few could also identify circuit B. The most common wrong answer was circuit E, with 3 cells in parallel. Most candidates identified the third statement in the list correctly, but many incorrectly believed that adding the second buzzer in parallel would increase the total resistance of the circuit.
- 6 A significant number of weaker candidates failed to identify light as an example of a transverse wave in part (a) and many also seemed unfamiliar with the use of the term 'perpendicular'. Most candidates identified wavelength as a correct answer in part (b) although some weaker candidates were found to use terms more familiar in art, such as shade and tone etc. Better candidates performed well here. Performance in parts (c) and (d) (i) was very much in line with candidates abilities. Part (d) (ii) did not differentiate well and produced an almost random distribution of ticks, often more than the two required as candidates were not told the number of correct statements.
- 7 This question showed a wide range of responses. Most candidates could score at least 1 mark, either for showing some kind of curvature on their completed diagrams. Better candidates did not alter the wavelength and were able to name the process as diffraction. A very few candidates managed to show little or no diffraction in diagram B. Where the written statement was correct but appeared to contradict the diagram for B, benefit of the doubt was applied.



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