RECOGNISING ACHIEVEMENT

GCSE

Physics A

Twenty First Century Science Suite

General Certificate of Secondary Education **J635**

OCR Report to Centres

June 2012

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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 specification 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.

CONTENTS

General Certificate of Secondary Education

Physics A (Twenty First Century Science) (J635)

OCR REPORT TO CENTRES

Overview

In this final full session of J635 Physics A the vast majority of candidates were entered for Unit 3 A333. Performance was good and reflected well on the preparation of both candidates and Centres.

As always it is a pleasure to see candidates who are knowledgeable and have been well prepared, performing well in the Physics A examinations. In particular it is good to see nearly all candidates across the ability range attempting the longer free response questions. Unfortunately the problem of candidates not having calculators in the examination persists, seriously disadvantaging many. Questions are written based on the assumption that candidates will have access to a calculator.

Candidates' performance in Unit 1, A331 and Unit 2, A332 were significantly different. In particular the entry for A331 was noticeably weaker than in previous sessions, this is not too surprising as we are approaching the end of the life time of this specification and a much higher proportion of the candidates were re-taking the module. A consequence of this was that the percentage of candidates gaining the higher grades was significantly lower. There was also some evidence of change in the entry for Unit 2 A332.

I would like to take this opportunity to thank all the Centres and candidates who have followed this course and positively demonstrated their understanding of physics and its applications in our society.

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.

Candidates performed better on the objective type questions, which formed two-thirds of the paper. The free-response questions were poorly answered by those candidates who have difficulties expressing themselves in writing.

The vast majority of candidates completed all questions in the time allowed and were entered for the correct level paper.

Most candidates showed an understanding of the Earth based on more familiar topics. In general, questions on plate tectonics, the greenhouse effect and electricity were well answered. The questions on the Solar System and beyond proved more difficult.

The majority of candidates would benefit from exploring the idea of renewable energy in more detail. The idea that energy can be re-used or used over and over again was the most common misconception that examiners reported.

Almost all candidates did not know that energy in a nuclear power station is produced by changes in the nucleus.

Comments on Individual Questions

1 (a) (i) Incorrect units for distances were given in metres, miles and years. Many attempted to calculate a distance from the numbers given instead of selecting the value 10.5 light years from the information given.

1 (a) (ii) The majority of candidates could correctly choose at least one method for identifying the distance.

1 (b) This question proved difficult with the majority of candidates unable to build a sequence in which the diameter of the Earth's orbit was larger than the Sun, or which placed the diameter of the Earth's orbit, the diameter of the Solar System and the distance to Epsilon Eridani in the correct order.

1 (c) This was the question most likely to have been left blank by candidates. Other non-scoring answers included collections of objects that were not arranged in any way. However, the question discriminated well between the most able candidates on this paper and the rest; there were a few excellent representations of the new Solar System, both 2 dimensional and 3 dimensional. Some candidates chose to draw our Solar System, which, if correct, qualified for full marks. The marks for the star and the planets were awarded most often. Very few correct comets were seen.

1 (d) The vast majority of candidates could give at least one of the two correct reasons why publication in a peer reviewed journal is important for the acceptance of the scientists' findings.

1 **(e)** This question discriminated well between candidates. Few of the weaker candidates realised that distant galaxies are moving away from us or that what we know about galaxies comes from the radiation. More of the more able candidates were able to select both these choices.

2 **(a)** This was answered well with the majority knowing where the youngest rocks are found.

(b) The majority of candidates knew at least one reason why the theory was rejected, and many gave both reasons.

3 **(a)** Beta radiation was correctly identified by many candidates.

(b) This proved to be the most difficult part of question 3, with the majority unable to identify microwave radiation as having the lowest energy.

(c) Infrared was the most common incorrect response here, followed by microwave.

4 Candidates found this one of the most difficult questions on the paper. Most candidates scored zero marks, and the full 4 marks was rarely awarded. The information about it being very dark in the countryside at night led some candidates to discuss light pollution rather than using the information about the general model from the diagram. The question exposed a lot of misconceptions – the general model is still not accepted by some candidates. Those who did understand had some problems expressing themselves and repeated too much of the model, for example, by saying 'radiation' and not explaining that this was light they lost the fourth mark. By failing to discuss the transmission through space, or the Earth's atmosphere, they lost the second mark. The mark most commonly awarded was for the light reflecting from the Moon, but some candidates failed to say where the light was reflected from, or what was reflecting the light.

5 Question 5 was very well answered especially parts (b) and (c).

(a) Most candidates were able to identify one or two of the correct statements about the greenhouse effect.

(b) The vast majority of candidates knew that the Earth's temperature would increase.

5 **(c)** **(i)** While the vast majority of candidates knew that more skin cancer would not be directly caused, surprisingly, some of the more able candidates taking the paper selected 'rising sea levels'.

5 **(c)** **(ii)** Most candidates correctly described the relationship as a correlation, a few chose 'variable'.

6 Question 6 was well answered.

6 **(a)** Most candidates could identify one correct reason. The more able candidates knew that electricity was convenient because it was easily transmitted and could be used in many different devices.

6 **(b)** The majority of candidates knew why electricity was called a secondary energy source.

7 **(a)** Many candidates lost the mark here because, after saying that the source would not run out, they went on to explain that the energy could be re-used, used again, or even used over and over again. In answers linked explicitly to the waves there was some evidence that some candidates thought it was indeed the same wave that was moving inshore and then receding out before coming in again and again.

(b) This question discriminated well. Some candidates included the 150m in one of the boxes. Some candidates correctly calculated the wasted energy but lost a mark for failing to put any units in the boxes.

(c) About half of the candidates knew the meaning of sustainable development.

8 **(a)** Candidates found this one of the most difficult questions on the paper. Very few knew that the energy came from the nucleus, and most thought it came from burning the fuel, with 're-using low level radioactive waste' being the second most popular incorrect answer.

(b) Most candidates selected one or both of the correct statements about radioactive materials.

(c) Some candidates did not understand this question, and others could not suggest a sensible reason. The majority were able to suggest one reason, usually 'more pay'. Surprisingly few explained that it was because the employee thought the benefit outweighed the risk.

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

General Comments

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

Half of the marks on this paper were awarded to objective type questions and half 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.

Other points that Centres should consider are 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 are required also caused problems for some candidates.

Comments on Individual Questions

1 Part (ai) proved to be a difficult question with the majority of candidates giving the answer 1827 years (2012 – 185), omitting to add the 8200. Parts (aii) and (b) proved popular with well chosen answers and the majority of candidates scored all four marks. In (c) the majority of candidates incorrectly answered gold and iron, with very few choosing either helium or hydrogen.

2 Three quarters of candidates knew the answer to (a) to be 10cm/year, with 1mm/year being the main distracter. In (bi) about half of candidates knew the light and dark bands were caused by the direction of the magnetic field whilst the other distracters were chosen fairly equally. Part (bii) was rather poorly answered. Although some candidates stated that the Earth's field reverses, most omitted reference to the Earth and simply stated that the magnetic field just changes. Few candidates mentioned that magma rises at the junction of tectonic plates or when the oceanic plates moved apart. A significant number of candidates stated that the magnetic field becomes fixed in the rock as the magma cooled. In (biii) the majority knew that the magnetic patterns suggest that the seafloor spreads apart, but fewer scored the second marking point about how this provided part of a mechanism for continental drift.

3 In part (a) the majority of candidates scored one or two marks, with fairly even distribution between the three correct answers and the distracters being chosen equally often. Part (b) was a better answered question with the majority of candidates scoring two marks and a high minority all three marks. The one choice most often missed being that some radiation from the Sun is reflected from the Earth.

4 Most candidates scored two marks. They were able to state that the Sun was the radiation source and that the radiation was reflected off the moon. Very few mentioned how the radiation could travel through space and the Earth's atmosphere. The radiation detector mark was sometimes lost because there was no mention that visible light was the type of radiation being detected or that it was the eye that was the detector; good answers stated that the eye/retina detected the reflected light from the moon. A few candidates had light incorrectly travelling from the Sun to the Earth then to the moon and finally back to the Earth.

5 Whilst part (a) was fairly well answered, with very few candidates not scoring at least one mark and a good number scoring both marks, part (b) proved to be very difficult with very few candidates ticking all four boxes and realising that all four radiations heat up an object. Many candidates just identified infrared and microwaves.

6 In part (a) a significant number of candidates ignored the fact that Kevin made two return journeys per week and therefore calculated the dose based on one journey there and back gaining an answer of 10.4mSv. It was surprising how many candidates did not know how many weeks there are in a year with 48 and 56 being quite common. In part (b) only a minority of candidates were able to relate perceived and actual risk to the case study and compare the risks to either Josie OR Kevin. Many candidates attempted to define perceived and actual risks in general terms without any reference to the case study. Those who did relate the risks to the case study often split the perceived and actual risk between Josie and Kevin (eg. Josie had the real risk and Kevin had the perceived risk), rather than relate the two risks to one person.

7 Part (a) proved a very good discriminator for the more able candidates, the vast majority stated that a renewable source will not run out, but then weaker candidates went on to say that it can be used again and again and so lost the mark. In (bi) the majority put the correct figures in the Sankey diagram but missed out the units and in part (b) the calculation was poorly done, with 750/7500, 7500/750 and 8250/750 being seen on a regular basis. Part (c) was well answered.

8 This question also proved a good discriminator, with the more able scoring three marks quite easily whilst the less able wrote down energy and motor for the two responses in (a) and wind farms, water, oil, hydrogen etc as a primary energy source in (b).

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

General Comments

This is the last paper of the legacy specification. Most candidates were very well prepared for the examination. There was no evidence to suggest that candidates ran out of time on this paper.

The level of understanding on this paper was good and Centres are commended for the way they have prepared candidates for the examination. There were some more challenging questions that stretched the most able candidates, as shown by the wide range of marks achieved.

There is evidence that some candidates didn't have electronic calculators in this examination. Candidates are reminded that they are at a disadvantage if they do not have all of the required equipment in the examination.

Comments on Individual Questions

1 This question was seen as a gentle start to the paper and as such most candidates scored very well. The only part of the question that was more challenging was part (b). The most common mistake here was to confuse the distance-time graph with a speed-time graph.

2 This question was more difficult and lower ability candidates found it challenging. Many candidates scored the mark for the momentum but found it difficult to remember the units of momentum. In part (b), many candidates referred to changing forces rather than comparing the driving force with the counter force. Many candidates thought the driving force must be increasing as the plane got faster. Some candidates suggested that the mass of the plane was increasing.

3 Most candidates scored well on the first part and the last part of this question. The idea of interaction pairs still causes candidates difficulties. Only the best candidates scored well on part (b) of this question. In part (c) a number of candidates thought friction was the correct answer.

4 This question discriminated well amongst the candidates. In part (b), the candidates are reminded to use the bullet points carefully to help structure their answer. Doing this will help candidates to score well on these questions.

5 Candidates showed a good understanding in question 5 and were able to apply this to a new situation well. Most scored highly on the first part. The depth of understanding required in the second part resulted in this being less well done, with many candidates thinking reflection would cause light to change speed. Part (b) suggested that candidates understood the electromagnetic spectrum, whilst part (c) was more difficult. Many candidates did not compare the size of the gap with the wavelength of light, required to gain the second mark.

6 Part (a) was surprisingly poorly answered with many candidates suggesting analogue and digital as the answer for this question. Candidates were well prepared for part (b) and scored well. In part (c) many candidates chose 200 m/s indicating they had not converted from cm to m in their calculation.

7 This question was common to this and the higher tier paper. Many candidates gained one or two marks in part (a), but failed to gain a third by omitting reference to electron transfer. In part (b) candidates are reminded to read the instructions in the question carefully and only draw the number of lines required by the question.

8 Many candidates scored well in part (a). Candidates are still unsure about the household voltage being 230V. Centres should be commended for their preparation of candidates for the calculations in this paper. The level of response to calculations such as part (b)(ii) continues to improve. Part (c) proved a little more challenging, with only the best candidates scoring well on electricity price calculations. The drawing of the thermistor was also difficult for many candidates. Centres are reminded there is a list of required electronic symbols in the appendix of the specification.

9 This challenging question was well answered by many, although candidates are reminded to read the instructions carefully to ensure they are drawing the correct number of lines.

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

General Comments

The paper appears to have been well received by candidates with most attempting the majority of the questions.

The time allocation did not seem to have been a problem for candidates.

Differentiation was achieved with many questions accessible to all candidates and with some challenging questions on which only a few candidates scored full marks.

Comments on Individual Questions

1 (a) (i) Many correct responses of 20m/s although 0.02 m/s was the most common incorrect answer and 1200 m/s was also frequently circled.

1 (a) (ii) Despite the word '**one'** being printed in bold type, many candidates drew three lines and consequently obtained zero marks.

Several others linked instantaneous speed with speed shown at a particular time.

1 (b) (i) Most candidates scored at least one of the two marks, with the first statement being the most common incorrect response.

1 (b) (ii) Very few candidates scored this mark. Common errors included sloping lines in part D and nothing drawn in part A. Curves were often drawn in various places on the graph.

2 (a) Most calculated the momentum (4) correctly, but there was a wide range of responses for the units, with J being the most common incorrect one.

2 (b) This question differentiated well. Many candidates were able to compare the driving and counter forces, and resultant force was often calculated, but candidates then neglected to state the effect of this. Many said that the driving force was increasing.

3 (a) Few candidates scored 1 mark here; either 2 or 0 was awarded. The most common error was 'the weight of the gymnast' linked to 'pull of gymnast on rings'.

3 (b) (i) The majority of candidates scored 1 here. The most common error was 9375N.

3 (b) (ii) There were a number of nil responses. Many candidates gave 20m/s as a response. Most of the candidates who realised that the kinetic energy formula was needed were able to calculate the speed correctly, with just a few making mathematical errors.

4 (a) Many candidates scored here. Those obtaining only one mark usually did so by correctly linking the digital signal.

4 **(b)** Many correct responses. The box most frequently left un-ticked was 'when a signal is amplified, noise is also amplified'.

4 **(c)** Majority of candidates scored 1 here, with just a few incorrectly circling the first formula.

5 **(a)** **(i)** Most candidates answered correctly, with no pattern of incorrect responses.

5 **(a)** **(ii)** Most candidates scored 0, often with both sentences incorrectly completed. All possible incorrect combinations of responses were used in approximately equal numbers.

5 **(b)** **(i)** Most candidates scored both marks.

5 **(b)** **(ii)** Very few candidates appeared to understand diffraction. Responses such as 'light is too fast', light cannot be seen' and diffraction occurs only with sound and water' were common. Confusion between 'lens' and 'aperture' was noted. There were more nil responses on this question than on any other on the paper, but some candidates scored the 2 marks.

6 **(a)** Most candidates scored this mark, but 'analogue' and 'digital' occasionally appeared.

6 **(b)** **(i)** & **(ii)** Nearly all candidates obtained both of these marks.

6 **(c)** 200m/s was a common mistake here as some candidates failed to read the units, but many answers were correct.

7 **(a)** Almost all candidates attempted this question and most scored at least one mark. The most commonly missed mark was for the electron transfer. Protons were frequently mentioned, as were positive electrons and magnetic poles.

7 **(b)** As in Q.1(a)(ii) many candidates ignored the bold '**one**' and drew three lines. Those incorrect with one line usually started from the correct box, but joined it to the bottom box on the right hand side.

8 **(a)** A significant number of candidates were confident with the calculation of current and scored full marks. A few scored the use of 230V mark, but many did not attempt the question.

8 **(b)** Very few candidates scored both marks. There was no pattern in the incorrect responses.

8 **(c)** Some candidates coped with this question. 11.5 was a very common incorrect answer, but it was occasionally used in a calculation to score a mark.

9 Some candidates scored three marks with excellent clear and concise explanations, but there were many nil responses and many confused and incorrect statements, such as 'flow of electrons in the core', core is a conductor of electricity', 'magnets spinning in the coils' and 'voltage induced in the primary'.

A333/01 Twenty First Century Science Physics A (Ideas in Context plus P7) Foundation Tier

General Comments

The paper was generally well attempted and produced a satisfactory spread of marks.

Candidates seem to have been well prepared for the objective style of questioning.

Candidates produced a range of responses to the free response questions, although there was evidence that a significant number of candidates struggled to use diagrams in answering questions.

The level of difficulty was appropriate for the ability range and most questions were accessible to candidates across the Grades C to F range. The majority of candidates generally performed well.

Most candidates correctly followed the instructions in the questions and most made their responses appropriate to the number of marks available. A significant minority, 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 This question was based on the pre-release article “Scientists review evidence for the extinction of the dinosaurs”. Most parts of this question showed good differentiation, apart from (d) and (eii) which proved largely inaccessible for candidates on the foundation tier. The majority of candidates were able to make appropriate use of data from the graph in part (b) and the objective parts of the question were well tackled. In part (ei) most candidates could at least partially describe the process of peer review coherently, although weaker candidates showed confusion over who carried out the review and/or what the review might entail.

2 This question examined ideas regarding the relative motion of astronomical objects. Part (a) was well answered by a large majority of candidates, although (aii) caused some weaker candidates difficulty. They often confused the rotation of the Earth on its axis with the orbit of the Earth around the Sun. Part (b) showed good differentiation with ability. Diagrams from lower ability candidates in parts (c) and (d) were generally poor and little use was made of written comment to support their drawings. Even the most able candidates struggled to communicate their ideas in part (d). Candidates should be encouraged to label their diagrams fully and to annotate them for improved communication of meaning when faced with this type of question.

3 Most candidates scored around half of the marks on this question. Most candidates got the point regarding less interference from the atmosphere in part (a), but a significant number felt that the second point was that they were closer to the stars. More able candidates picked up at least one mark for part (bi), usually for an economic argument, but relatively few candidates scored on (bii). Part (ci) posed few difficulties, but only a minority of more able candidates coped with the question on parsecs in (cii). A relatively high level of ‘no response’ was seen on this part of the question. Most candidates picked up at least one mark on the final part of the question.

4 A small majority of candidates could recall that helium is the product of hydrogen fusion in the Sun, but only the most able of candidates could describe how we know the elements present in the Sun. For most candidates part (b) proved rather hit and miss, with most candidates picking up one or two marks but with no clear pattern emerging. Most candidates coped well with parts (c) and (d), although “it will go out” proved a popular distracter in part (c).

5 Overall, this question differentiated well, although even more able candidates failed to pick up more than two thirds of the marks. The two diagrams were very poorly tackled by the vast majority of candidates. Very few candidates made use of a ruler to draw rays of light and most seemed unaware of the direction taken by reflected rays in part (ai). In (bii) for the majority of candidates there was little evidence that they had tackled this kind of exercise before as responses were very poor. The remaining parts of the question proved equally difficult for the majority, with the exception of part (bi) which was an objective question about the lenses in a telescope.

A333/02 Twenty First Century Science Physics A (Ideas in Context plus P7) Higher Tier

General Comments

The candidates covered quite a wide range of abilities, with the increase in candidates at the lower end of the ability range noted last year continuing. There was a good spread of marks. The majority of candidates made a good attempt at the paper, with nearly all candidates attempting all questions. There was no evidence of candidates running out of time.

There was clear evidence that candidates were responding to longer prose style questions better this year with most filling the available space with writing. Unfortunately this was still too often vague and consisted of little more than a rephrasing of the question, rather than demonstrating their own knowledge and understanding. The quality of writing was often poor; deciphering their answers was often difficult.

Many candidates lost marks through not reading through their script at the end of the examination. Omitted words often led to unclear and/or ambiguous explanations.

Comments on Individual Questions

Question 1

(a) (This part of the question was common with the Foundation paper).

Candidates seemed well prepared for part (i) of the question and there were numerous responses that gained full marks. The best answers showed a clear understanding of the role of peer review whilst the weakest often used 'peer' incorrectly. Most responses were well structured and used appropriate terminology. In part (ii), candidates found it difficult to explain this concept with clarity. Many responses referred to 'new' data or showed a lack of understanding of its purpose. The weakest answers often just copied information from the text rather than providing any explanation.

(b) This was well answered by many candidates who were able to describe an asteroid in context. The best answers used relevant additional details, whilst the weakest lifted information from the text or only referred to asteroids that had collided with the Earth.

(c) Candidates found it hard to write concise responses that addressed this question. Many selected irrelevant information from the passage, rather than providing a sequence of events. The best responses used appropriate terminology and were able to convey an understanding of the events, whilst weaker responses often lacked clarity or gave vague or incorrect explanations, e.g. 'nuclear winter', 'dust in the air'.

(d) The best responses showed evidence of reading the graph correctly and correct working leading to a correct numerical answer. Most correct answers were not expressed as percentages, but as a fraction or decimal. The weakest responses often showed an attempt to read the graph but did not communicate this clearly enough to be creditworthy, often omitting 'years', and then showing a lack of understanding in how to process the information.

Question 2 (This question was common with the Foundation paper)

(a) Most candidates scored highly on part (i); although the quality of drawing varied, diagrams were clear enough to gain full credit. Some candidates drew a mirror in a telescope. The best answers had a clear line mirror with an indication of the silvered side, used a ruler to draw several parallel rays and indicated a focal point. Weaker responses were characterised by freehand sketches, with mirrors which looked like plano-concave lenses and freehand rays. The weakest, non-creditworthy, responses had light passing through a 'mirror' rather than evidence of reflection. For part (ii), the best responses were characterised by a succinct statement meeting both marking points. Many candidates incorrectly included comments about diffraction effects. Weaker answers used vague descriptions such as 'faint light'.

(b) Part (i) was generally well done. The common correct response was 'Each lens has a different power', with no apparent pattern to incorrect responses. For part (ii) the best responses had 2 correct rays, drawn with a ruler, meeting at a point focus. Many candidates did not use a ruler to draw rays and so had images outside tolerance. Other common errors were extended images, images drawn on the Principal Axis and 1 ray missing. In part (iii), the best responses showed an understanding of the purpose of computer control in this context, while the weakest often referred to collecting data/viewing images/advantages of remote control, etc.

Question 3

(a) In part (i) many responses were correct and had a simple arch and arrow. Many candidates drew objects at several points indicating an arch, although some included the Earth or had fixed stars / stars going in a horizontal motion. Fairly common errors were to show the moon moving from west to east or the stars as fixed. Candidates found part (ii) difficult with only a few getting the sequence correct. There was no obvious pattern to the errors, suggesting candidates had not learnt the periods required to answer the question.

Responses to part (b) fell into two broad groups – one where candidates had learned and were able to reproduce diagrams and explanation for retrograde motion and ones which either had little or no understanding of the process. The weakest answers often had Mars travelling faster/on a closer orbit or used Venus rather than Mars. The very weakest often lacked any appreciation and used 'caused by black holes close by' or 'the Earth spins on its axis/is the other side of its orbit'.

(c) Part (i) was correctly answered by most candidates, the most common error was the phase shown in the furthest right diagram. Few candidates could draw the phase 14 days later for part (ii), the most common error was a 1/4 bright moon. In part (iii), the best answers scored 2 marks from a clear diagram showing the Moon’s orbit around the Earth tilted relative to the Earth’s orbit around the Sun. Although many diagrams were poorly drawn and had two, indistinct, orbits. The weakest often referred to axial spin rather than orbital tilt.

Question 4

(a) Few candidates considered the specific context of parallax measurements. Most candidates made an appropriate reference to atmospheric interference and so scored 1 mark, although they described this in far too much detail. Very few referred to a larger baseline/angle.

(b) This was generally well answered. It looked like many Centres had used previous mark schemes to teach ‘sharing costs and pooling expertise’ as this exact wording occurred a lot. Most referred explicitly to the idea of sharing costs or it being too expensive. Many gave the idea of sharing experts/ideas/intelligence.

(c) For part (i) most candidates were able to describe the method, however many candidates just made comments about close/distant stars and the comparative size of their parallax angles. In Part (ii), a surprising number included the star's identification number in their calculation. Those gaining 2 marks often did so whilst quoting an unrealistic number of significant figures. Whilst this wasn't significant in this question, it showed a lack of understanding of how to present a final numerical answer.

(d) This was generally well done with many candidates identifying the correct responses of temperature and size of star. The most common errors were the Hubble constant and period of variation of brightness.

Question 5

(a) There were a good range of responses here. The best responses were clear and ordered, using appropriate terminology throughout. Good responses usually referred to convection currents and to light leaving the photosphere, but omitted or only had vague comments about the radioactive zone. Weak answers had some idea of the zones, but in an incorrect order and either without mechanisms or with incorrect ones. The weakest responses used the model of the structure of the Earth and referred to (misnamed) zones without any mechanisms. Many candidates spent time restating information from the stem or describing fusion.

(b) Parts (i) and (iv) were well done, but the other parts less so. Common errors were E in part (ii), C in part (iii) and D in part (iv).

(c) Examiners were impressed that nearly all candidates were able to correctly answer this question.

Moderation Report on GCSE Physics A

General Comments

This is the last year of operation of this specification and it has clearly been a most rewarding experience for the teachers and students involved. It has also been a pleasure for the moderating team to see the imaginative ideas that teachers have developed to engage their students and inspire them to show the best of their skills in the assessment. **For next summer, tasks will be set by OCR under the new Controlled Assessment procedures and Centres must check the new unit entry codes and other requirements.**

There has been a continued improvement in a number of areas in the interpretation and application of the assessment criteria. However, certain aspects have continued to be demanding and challenging for candidates and the spread of marks over the cohort is sufficient to allow secure differentiation between grades.

Section 1: Administrative issues

Whilst the majority of Centres have excellent administrative procedures in place there were still a significant number who caused the moderating team a considerable amount of extra work to ensure that candidates were credited with the correct marks. Few Centres included details of how each of the tasks used for assessment had been introduced and presented to candidates and this meant that on occasions moderators could not easily find the evidence to support the marks that were awarded by the Centre.
Most candidates' work was annotated with the use of the assessment criteria codes, however, in a number of cases the annotation was a very generous interpretation of the criteria and sometimes completely incorrect.
There was evidence that some coursework from a small minority of Centres had been reviewed and annotated by teachers giving candidates specific guidance about how to improve their marks. Another example of unacceptable assistance included the use of helpsheets giving detailed task specific points and leading questions involving particular words or phrases in the mark descriptions.
There was evidence that in some cases, particularly in the Case Study, candidates were copying and pasting information from websites without acknowledgement and referencing of the source. This action constitutes malpractice, for which a penalty may be applied.

Section 2: Assessment and marking framework

A significant number of Centres were still not following the correct procedure for calculating the Strand mark from the appropriate aspect of performance marks and were required to re-calculate or re-mark their candidates' work. Each aspect of performance should be considered in turn, comparing the piece of work first against the lowest performance description, then each subsequent higher one in a hierarchical manner until the work no longer matches the performance description. There was a tendency for some Centres to award marks on the basis of candidates matching one high level aspect of performance description within each Strand without ensuring that the underpinning descriptions had been matched.

Section 3: Data Analysis

General comments

Those candidates who understood and used the terminology and concepts related to Ideas about Science, such as 'correlation and cause', 'outliers', 'reliability', 'accuracy', 'best estimate' and 'real difference' found it easier to match the performance descriptions of the criteria and gain higher marks.
The majority of candidates at nearly all levels repeated their measurements when performing practical tasks. However, they did not necessarily appreciate the reasoning behind such practice and often those results which were clearly outliers were included in calculating averages and incorporated into conclusions. It was very rare to see that a candidate had performed further repeats to replace the outlier to ensure that the data is reliable and of the best quality. Plotting rough graphs as the data is collected may help candidates to identify outliers as they are collected.

Strand I: Interpreting data

Whilst many candidates now plot all their data and often include range bars, the quality of graph drawing often shows lack of care in plotting the points accurately or using suitable scales and labelling axes correctly or drawing a line of best fit accurately and carefully. Many graphs were given high marks when one or more of these aspects were not of the accepted quality.
The match to I(b)4, 'identifying trends or general correlations in the data', was well appreciated. However, many candidates referred to 'positive correlation' which only merits 4 marks rather than the 6 marks which was often awarded. For 6 marks candidates should derive a more quantitative statement using their data to show what happens when, for example, concentration or lengths are doubled and noting the direct proportionality between variables.
Most candidates could secure a match to I(c)4 by explaining their conclusion using scientific ideas. However, there was still some very generous marking when matching to I(c)6 and I(c)8 in terms of the detail and quality of the scientific knowledge and understanding shown.

Strand E: Evaluation

Those candidates who used sub-headings such as 'Evaluation of procedures', 'Evaluation of data', 'Confidence level of conclusion' were more likely to focus on each area in turn and be more successful in their overall evaluation.
Most candidates could identify limitations or problems in their procedures to match E(a)4 although in many cases comments were limited to human error rather than systemic experimental ones. A number of the suggestions for improvements were not of sufficient quality to securely match E(a)6.
The majority of candidates generally identified a data point as an outlier either in the table of results or on a graph with range bars to match E(b)4, but only the better candidates provided an explanation of why a particular result had been chosen. The majority of candidates now regularly draw lines of best fit and range bars on their graphs but many of them do not make the connection to reliability and accuracy when discussing their data.
Marks for E(c) were often very generously awarded and this aspect still continues to be poorly addressed. Better candidates referred back to their conclusion in I(b) expressed in either qualitative or quantitative terms and used their discussion in E(a) and E(b) to link them all together in establishing the appropriate level of confidence.

Section 4: Case Studies

General comments

The Case Study is a critical analysis of a controversial scientific issue in which candidates use their knowledge and understanding of Ideas about Science. Those candidates who were able to use the language and concepts related to IaS, found it much easier to match the performance descriptions of the criteria and gain higher marks.

In general, candidates continued to perform better in Strands A and D compared to B and C. Higher achieving candidates described the relevant science needed to understand their chosen topics and produced high quality, clearly structured, well resourced and illustrated reports involving critical analysis and individual thought with considerable personal input. It was this latter aspect of personal analysis and evaluation which often differentiated candidates in terms of level of performance. Lower achieving candidates relied too heavily on copying and pasting information from sources without the appropriate level of individual analysis and evaluation.

Strand A: Quality of selection and use of information

The majority of candidates included a bibliography of sources with the majority from the internet at the end of their reports with complete references to the exact URL address of the webpage. Only the better candidates provided some information about the nature, purpose or sponsorship of the site. Candidates were still not very good at clearly showing where sections of text were directly quoted. Better candidates also included references within the text to show the source of particular information quoting the specific author and then explaining why it was chosen and how it contributed to the arguments being compared.

Strand B: Quality of understanding of the Case

Only the most able candidates could integrate their scientific knowledge and understanding with the claims and opinions reported in their studies or extend the scientific knowledge base to more advanced concepts. Reporting was too often still at the ‘headline level’, simply repeating claims without looking behind the headline for the underlying science and/or evidence. Candidates who were awarded 6 marks referred to the evidence base of the various claims and opinions providing generally quantitative information from research studies. Candidates obtaining 7 or 8 marks looked more critically at the quality of the evidence. They used terms like ‘reliability’ and ‘accuracy’ when considering data, they looked at the strategies involved in collecting the data and they also compared the reliability of data between sources.

Strand C: Quality of conclusions

Most candidates could sort the information that they had gathered into views ‘for and against’ and were awarded 4 marks in C(a). Better candidates started to compare similar aspects in both their ‘for and against’ list and were awarded 6 marks. The best candidates built on this foundation and provided detailed comparisons and evaluation demonstrating considerable analytical and evaluative skills. When making their conclusions, the best candidates described their own viewpoint or position in relation to the original question justifying this by reference to the sources and to the evidence that the claims were based on. Many candidates simply chose to report information about their topic, without any real analysis of the scientific evidence and incorporation of personal decision making.

Strand D: Quality of presentation

The majority of reports included headings and/or sub-headings (2 marks), a table of contents and numbered pages (3 marks) to help guide readers quickly to particular sections. Those candidates who in addition presented a report which had a coherent, logical and consistent style were awarded 4 marks. More candidates now include informative images but only the best candidates refer to and use the information to clarify difficult scientific ideas and improve effective communication.

Section 5: Investigations

Rates of reaction, resistance of a wire and osmosis were still the most common investigations seen from Centres.

Strand S: Strategy

Although there was evidence of candidates doing preliminary work, it was often the case that candidates from the same Centre used the same quantities of materials, the same apparatus and technique and identical ranges and values of the same variables. This clearly indicated that limited individual decision making had occurred. The best candidates performed preliminary work and used the data collected to inform and develop the main experiment. These candidates considered what factors or conditions might affect their results which usually involved a brief review of the relevant scientific theory supported by one or two simple practical experiments to compare the magnitude of the different effects and ease of experimentation. This allowed candidates to decide which factor it would be best to study and also provide evidence which could contribute towards credit for C(a) and C(c).

Many candidates provided a list of appropriate apparatus for their investigations but had not linked it to their preliminary work and not indicated why the apparatus had been selected in preference to alternative equipment.

The complexity of a task, S(a) depends on the demand and challenge involved in the approach adopted by the candidate and too often 7 or 8 marks were awarded for straightforward approaches to the task. 'Resistance of a wire' investigations were frequently over marked in this aspect.

Strand C: Collecting data

It was pleasing to see that the majority of candidates used suitable ranges of the appropriate variable to study and appreciated the need to repeat their measurements to obtain a wide range of data. However, a discussion of the factors to control was often rather limited for C(a) and only the better candidates described in detail how the factors had been controlled and monitored during the experiment.

There was continuing evidence this year that candidates were doing preliminary work to establish the range of values of the appropriate variable to be used C(b). However, although some candidates presented their results in a table they did not use the results to explain how it informed their main method. Too often, candidates did not consider their results as they were being collected so that obvious outliers were either ignored, or included without comment when calculating average values. It was very rare to see that a candidate had performed further repeats to replace the outlier to ensure that the data was reliable and of the best quality.

From inspection of results tables it was pleasing to see that candidates were taking more care and data was generally of good quality. However, there was little evidence of candidates performing preliminary work which involved making decisions about adapting the type of apparatus or method to ensure the collection of the most accurate and reliable data (C(c)).

Strands I and E

In general candidates achieved their poorest marks in these two Strands. For more details see the comments in the Data Analysis section.

The Twenty First Century Science model for Investigations aims to give credit for candidates who process their results, look for patterns and then suggest explanations using their scientific knowledge and understanding. Very often candidates did not link their conclusions with their scientific explanations I(c).

Strand P: Presentation

This Strand was generally fairly and accurately marked by Centres. Spelling, punctuation and grammar were sound and the majority of candidates' reports were well structured and organised. However, experimental methods were rather briefly described and lacked sufficient detail. Diagrams of apparatus were not always included and although data was generally accurately recorded and presented in appropriate tabular form, units were occasionally incorrect or missing.

Section 6: Final comment

All members of the moderating team recognise the considerable effort needed by Centres in assessing and presenting candidates' work for moderation. We would like to record our thanks and appreciation for a thorough and professional job carried out by the majority of Centres. The structure of Case Studies, Data Tasks and Investigations has been modified in the new specifications in the light of the new regulations for Controlled Assessment. Training for the new model is on-going and details are available in the OCR Training Handbook. There is further guidance about the interpretation and application of the new assessment criteria on the website www.ocr.org.uk.

This seems an appropriate opportunity to thank Centres for the care taken each year in presenting work in such a well organised manner, and to wish you continued success with the new Controlled Assessment.

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