RECOGNISING ACHIEVEMENT

GCSE

Physics B

Gateway Science Suite

General Certificate of Secondary Education **J645**

OCR Report to Centres

June 2012

Oxford Cambridge and RSA Examinations

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.

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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.

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OCR REPORT TO CENTRES

Overview

Several examination sessions for these papers have been set now, and Centres are clearly using past papers to prepare their candidates thoroughly. Some candidates will also be accessing the papers directly from the OCR website which is admirable. As a result, generally the standard of answers continues to improve although these improvements are slight at this late stage in this legacy specification. Also the understanding needed to answer many questions has become more secure with most candidates. Whilst the contexts of questions do change, the science within them is largely from specification statements – and so that remains the same. Sometimes though, the contexts can disorientate candidates as they try to apply their knowledge and understanding to an unfamiliar context. This is more often seen in higher demand questions. Whilst this is still the case, candidates seem to be getting more confident at applying knowledge in these ways. This trend of applying knowledge in different contexts, even beyond the parameters of the specification is likely to continue. Indeed, in this series many questions have moved towards the style of the new GCSE specifications.

There are still a few common issues that it is worth reminding Centres about.

There will be up to 15 marks available on a paper (60 marks) for **short prompted responses**. These are often 'chose from a list' type questions. Usually it is the case that they are almost always attempted. The distracters in these papers are usually devised to test knowledge rather than to 'catch-out' candidates. Sometimes two answers are asked for but often only one response is given. Occasionally the answer is left blank, probably as there is no answer line. At the end of question papers it is a good idea for candidates to use their time to check for such omissions. These types of question are not always targeted at the lower grades on a paper. For example questions on star cycles can often follow this format and yet still remain firmly in the higher demand part of the specification.

Calculation questions as a rule are being completed well. This is partly due to the formula being present on the paper. However they do have to chose the correct formula and substitute the correct figures into it for 1 mark. The other mark is available for the correct answer. At higher level they may be asked to rearrange formulas too.

The usual errors are missing decimal points from one of the input values (eg 15V rather than 1.5V). Candidates also have a tendency to divide the numbers the wrong way; irrespective of the division it is tempting for candidates to put the smaller number in the denominator. So for example if the correct division is 3 / 6 which = 0.5 [2 marks]. Many will incorrectly divide 6 / 3 to get 2 [0 marks].

There was also evidence of candidates not using or forgetting to bring a calculator.

Calculations are increasingly being asked where candidates chose numbers from a range of values. These questions may contain distracters in addition to what is really needed to answer the question. For example a question to calculate acceleration given mass and force may also contain the distracters speed or energy. This makes the selection of correct formula more demanding.

Centres should remind candidates that scripts are generally scanned as black and white images, so the use of coloured pens or faint pencil is not recommended. In some instances, partially rubbed-out pencil lines were still visible. Often candidates' answers will not fit in the designated area. A sensible approach used by many candidates is to indicate part of the answer is elsewhere on the page. An arrow is often all that is needed to highlight this. This will then direct the marker to open up the whole page and mark accordingly. If no such indication is there then the answer may be missed.

The Principal Examiners' reports which follow indicate good advice for Centres and candidates alike. Heads of Science are advised to use them with their colleagues so that in classroom situations they can routinely and purposefully advise their candidates.

B651/01 Unit 1 Modules P1, P2, P3 (Foundation Tier)

General comments

This was a very small entry legacy paper with approximately 220 candidates.

Compared to previous papers, this foundation tier paper has an increase in the number of questions requiring more than one word answers and an increase in the number of three mark questions. The paper also has an increase in the number of questions requiring more than one answer for a single mark, for example, question 13(c). This question requires two things that increase braking distance, for one mark.

No candidate scored above 55. Less than 1% of candidates scored above 50 marks, and no candidates scored less than 10 marks. All questions scored and there were no 'dead' marks.

Candidates should ensure they show all their working for calculations, as there are marks that can be awarded when an arithmetic error occurs in the final answer.

Comments on Individual Questions

Section A – Module P1

1 (a) (i) Over 90% of candidates gained two marks for correctly linking the methods of insulation to where they are found.

1 (a) (ii) Less then 50% of candidates gained the mark for this question. Instead of suggesting how reflective foil is used, many candidates wrote about how reflective foil works and so did not gain the mark available.

1 (b) (i) Most candidates were able to calculate payback time to be 4.5 years. A few candidates incorrectly multiplied the cost and the saving together.

1 (b) (ii) Only about 25% of candidates were able to describe why trapped air is important in cavity foam insulation. Many candidates described how the air is trapped, rather than explaining that air is a good insulator or a poor conductor.

2 (a) (i) Over 60% of candidates correctly identified infrared as the type of radiation used for changing a TV channel. A surprising number of candidates thought the radiation involved was microwave.

2 (a) (ii) Only about 40% of candidates knew that microwave radiation is used to send text messages from a mobile phone. Common incorrect answers included 'gamma' and 'radio'.

2 (a) (iii) Over 50% of candidates described that ultraviolet radiation could cause skin cancer or sunburn, A few candidates did not gain this mark because they gave vague answers such as cancer, burns or damage.

2 (b) (i) Candidates found this question a challenge even though they were asked to complete sentences to show the parts of a standard wave diagram. About 40% of candidates failed to gain any marks for this three mark question. Of the candidates that did score marks, only 15% gained all three marks. The most common incorrect answer was not being able to recognise a trough. Many candidates also did not recognise a wavelength, as many just wrote 'length' or 'distance'.

2 (b) (ii) Just over 5% of candidates were able to choose the correct speed of the wave as 2.4cm/s. The majority of candidates did not look at the wave diagram to find out that the distance between A and F was two wavelengths and not one wavelength. As a result, they used the 8 cm as the wavelength and calculated the speed to be 4.8cm/s.

3 (a) (i) Just over 50% of candidates gained one mark for recognising that the infrared radiation travels along the fibre by reflection. Some candidates thought that the infrared radiation travelled by refraction or diffraction. Other candidates gave the answer of 'bouncing off the sides', which was not awarded a mark. Few candidates knew that total internal reflection (TIR) was involved.

3 (a) (ii) Just over 30% of candidates were able to describe how analogue signals and digital signals were different. Many only described digital signals correctly. A few candidates chose to illustrate their answers with diagrams, but these were only awarded marks if each diagram was clearly labelled to show which one was an analogue signal and which one was a digital signal.

3 (b) The majority of candidates gained one mark for writing about mobile phones being portable. Less than 20% of candidates were able to give another advantage and many just gave examples of how the mobile phone is portable rather than describe another advantage.

3 (c) Over 70% of candidates knew that a laser produces a beam of light or radiation, but very few correctly described the light as being intense.

Section B – Module P2

4 (a) (i) In this question, candidates were required to complete four gaps in the sentences for two marks. Many candidates correctly identified direct current as the type of current photocells produce, but were unable to complete the sentence about photocells converting light energy into electrical energy correctly. Many candidates thought photocells convert light energy into heat energy.

4 (a) (ii) Over 70% of candidates correctly calculated the power output to be 30W. A few candidates divided the voltage by the current or multiplied the 30W by the 8 hours, given in the stem of the question.

4 (b) Over 60% of candidates gained one mark for knowing that wind turns the blades of wind turbines. Less than 10% of candidates were able to complete the sentence to describe that wind is caused by convection currents. Many candidates left this part of the sentence blank.

5 (a) The majority of candidates correctly identified gamma as being the third type of radiation.

5 (b) (i) This application type question, about the amount of detected beta radiation suddenly dropping, was found to be a challenge by many candidates, with less than 10% explaining that the thickness of aluminium has increased.

5 (b) (ii) Just over 40% of candidates understood why alpha radiation cannot be used to monitor the thickness of the aluminium foil. Many candidates stated that 'alpha is stopped by paper', rather than applying their knowledge to this particular situation.

5 (b) (iii) Over 60% of candidates were able to describe a precaution to be taken when handling radioactive materials. Candidates who had not read the question carefully gave the answer of wearing protective clothing, which was given to them in the stem of the question.

6 (a) The majority of candidates were able to connect the Earth and Moon, solar flares and the Sun to the two sets of statements.

6 (b) This question required candidates to complete three gaps in the sentences for two marks. 70% of candidates knew that asteroids have made craters on the Moon's surface, but many fewer also knew that they are made of rock. The tail of a comet being made of a trail of debris was usually answered correctly.

7 This three mark question about the production and distribution of electricity from a non-renewable source was often left blank by candidates. There were bullet points to help candidates answer the question fully, but despite this, less than 20% of candidates gained all three marks. The majority of candidates did not name the energy source at the start of the production process.

8 Over 40% of candidates knew that we see stars because they give off their own light or are very hot. Fewer knew that stars start their life as a cloud of gas, and very few candidates knew that a large group of stars is called a galaxy or gave the name of a galaxy. Less than 10% of candidates were able to correctly answer all three questions.

Section C – Module P3

9 (a) Over 70% of candidates wrote down petrol and diesel as the names of two fossil fuels for one mark.

9 (b) (i) Almost 60% of candidates correctly identified vehicle A as being the one with the best fuel consumption.

9 (b) (ii) Over 75% of candidates correctly calculated 40 litres as the number of litres of fuel car C uses.

9 (b) (iii) 70% of candidates knew that electric cars store energy in a battery. A common incorrect answer was 'in the engine'.

10 (a) The majority of candidates were able to identify Jane as being the runner who is stationary from the distance/time graph.

10 (b) Slightly fewer candidates were also able to identify Andy as being the runner moving at steady speed.

10 (c) The majority of candidates were able to identify Nick as the runner with the highest average speed from the graph.

11 (a) Over 90% of candidates were able to write down the name of force A. The usual answer was gravity.

11 (b) Just over 20% of candidates gained both marks for describing how the air resistance is greater because Dan is less streamlined. Many of the candidates only described the force involved and did not explain why the upward force on Dan was greater.

12 (a) Over 70% of candidates chose car E as the car with the highest acceleration.

12 (b) Just over 55% of candidates gave the answer of the 600 kg Citroën as the vehicle with the highest acceleration.

12 (c) (i) The majority of candidates were able to calculate the work done by the bus as being 54 000J. A few candidates multiplied the force, distance and time together in their attempt at this calculation.

12 (c) (ii) Less than 30% of candidates were able to explain that the work done by the bus and the car were the same because they both have the same force and distance. The majority of candidates only wrote down that they had the same force and did not mention anything about the distance.

12 (d) Less than 20% of candidates were able to explain why the bus has the most kinetic energy. Candidates were required to explain that the bus had the greatest mass and greatest speed for the one mark. The majority of candidates only wrote about the bus having the greatest velocity and failed to mention that it also had the greatest speed.

13 (a) The majority of candidates were able to calculate the stopping distances for the car. A few candidates subtracted the thinking distance from the braking distance.

13 (b) (i) Candidates found it difficult to write down the meaning of thinking distance even though they were given a sentence to complete. Less than 50% of candidates completed the two gaps in the sentence. A common error was to write that thinking distance was the ‘time travelled before the driver thinks’.

13 (b) (ii) Candidates were required to write down two different things that increase thinking distance for one mark. Just over 40% of candidates gained this mark. Many candidates only wrote one answer or chose two examples of distractions e.g. children crying and mobile phones.

13 (c) Again, for this question, candidates were required to write down two things for one mark. They needed to write down two things that increased braking distance. Many candidates only gave one thing or if they chose mass, they did not specify that the mass needed to be increased. Less then 20% of candidates successfully answered this question.

B651/02 Unit 1 Modules P1, P2, P3 (Higher Tier)

General Comments

This was the last summer examination for this paper and there was a significantly reduced entry.

The mean mark was 35.9, with a standard deviation of 11.9.

All marks were accessible; the maximum mark achieved was 58 and the minimum mark was 0.

Comments on Individual Questions

Section A

1 The majority of candidates correctly calculated the payback time as 4.5 years in part 1(a). In part 1(b), about 75% were able to complete the table correctly.

2 Most candidates were able to correctly explain frequency. Of those failing to score, many gave an incomplete answer such as 'the number of waves passing a point', therefore missing the time element. In 2(b), the 4 marks were distributed between the laser beam and the CD. Two marks were awarded for describing the laser beam correctly and 2 marks for explaining how information is stored on a CD or how it is retrieved, or a mixture of both. More details can be gained from the mark scheme. Approximately half the candidates were able to answer this question correctly. In 2(c), the most common incorrect answer was 4.8cm/s, with approximately half the candidates not realising that the distance between A and F was 2 wavelengths. In question 2(d)(i), in order to score, candidates needed to state that the kinetic energy of the water particles increased. The word water was essential. The remaining part of the question was answered well. The idea that microwaves were reflected from the shiny walls, that they can pass through glass and penetrate to the centre of ready meals, was seen in the majority of candidates' answers.

3 In 3(a)(i), the majority of candidates correctly described Total Internal Reflection (TIR). If the description included a diagram, examiners were asked to look for two marking points; that all reflections took part at the boundary and that the angles were correct for TIR. Details are given in the mark scheme. In 3(a)(ii), candidates were in general able to describe the differences between analogue and digital, although the best descriptions were of digital signals. In question 3(b), the advantages of digital signals were not well known, with expressions such as no interference, rather than interference ignored or not amplified.

Section B

4 This question was answered well by the majority of candidates. Most candidates were able to score one mark in 4(a)(i), usually for completing the last sentence. About 20% also correctly completed the other sentence. Candidates were able to calculate the output power of the battery as 30W, but the inclusion of 8 hours in the question as extra information confused some candidates. In question 4b, most candidates knew the advantages and disadvantages of wind generation and scored well.

5 Many of the answers for question 5(a) were vague. Examiners were looking for a statement that more beta radiation was absorbed because the foil had become thicker. In 5(b), the majority of candidates knew that alpha radiation could not pass through even thin foil and in 5(c), candidates were able to describe safe ways of disposing of radioactive waste.

6 Approximately 95% of candidates correctly completed the pathways across the boxes in 6(a). In question 6(b), half the candidates were able to score one mark. with about 15% achieving both marks. Common errors were that asteroids were left from the Big Bang and that comets were made of rock.

7 Question 7(a) discriminated well, with approximately 25% of candidates scoring 0, 1, 2 and 3. Most of the candidates' responses were correct, but many failed to give sufficient detail. At least one advantage and one disadvantage were needed to score full marks. The calculation in 7(b) proved straightforward for the majority of candidates, with about 75% gaining full marks.

8 Few candidates were able to complete the notes correctly. The stumbling block was the radiation from the Big Bang. Examiners were looking for microwave as an answer.

Section C

9 Candidates knew that electric cars got their energy from either batteries or solar cells and that the batteries needed recharging. They were also able to link the recharging to the pollution produced in power stations when generating electricity.

10 The majority of candidates identified Nick as the runner with the highest average speed and were able to complete the calculation in 10(b) correctly. Overall, about three quarters of candidates scored full marks on this question.

11 Candidates were able to complete the sentence about acceleration correctly and in general could explain why parachutists start to accelerate. In 11(b), there were a variety of responses. Most included some correct science, but few were complete. The ideal answer was that Dan had a larger surface area and so more air resistance at a certain speed than Gita. This meant that drag = weight at a lower terminal speed. The reverse argument for Gita was also accepted. Only the most able candidates were able to answer 11(c) correctly. There were vague answers, such as the energy being needed to maintain the speed, which did not score.

12 The majority of candidates calculated the work done correctly, but a significant number divided by the time to calculate the power. Question 12(b) required both largest mass and greatest speed as the answer to score one mark. Few candidates gave both these answers; the majority gave a partial answer and failed to score.

13 The majority of candidates correctly identified two things that increased thinking distance in part (a). In part (b), however, candidates failed to read the question correctly and often gave poor or faulty brakes as answers, which were excluded by the question. Vague answers such as poor weather or bad road conditions were not accepted. Specific examples were needed, such as rain, snow or ice for the weather and icy, wet or greasy roads for the road conditions. Part (c) proved difficult for the majority of candidates, with only 30% scoring full marks. Working marks were given for several candidates. This is an example where it is essential to show all the working, as those who just gave an incorrect answer scored 0. The most common error was failure to use average speed, or area under the graph for the braking part of the distance.

B652/01 Unit 2 Modules P4, P5, P6 (Foundation Tier)

General Comments

There were approximately 1300 candidates and marks ranged from 4 to 52 out of 60. The mean mark for the paper was 24 which is lower than in previous sessions. The paper discriminated satisfactorily over the target grade range of C to G. The paper allowed candidates to demonstrate positive achievement.

There was little evidence that candidates had insufficient time to complete the paper, but there were a number of questions omitted by a significant number of candidates. It was pleasing to note that the majority of candidates showed their working for calculations. As a result, a good number scored marks which they would not otherwise have done.

There were some examples of handwriting which was very difficult to read and the intention of the candidate was so unclear that marks could not be awarded.

Comments on Individual Questions

1 **(a)** This was intended as an accessible starter and the majority of candidates knew that the charges would be opposite.

1 **(b)** The majority of candidates were awarded one mark, but few obtained both marks. The most common error was to believe the rod was the conductor and the cloth the insulator or vice versa.

1 **(c)** Two thirds of candidates correctly described what happens to the pieces of cork. Those who did not score the mark either thought they were repelled or more frequently, that nothing happened.

2 Almost every candidate was awarded at least one mark for placing the statement in the correct sequence. A significant number only had one step out of sequence and nearly half the candidates were awarded all three marks.

3 More than three quarters of the candidates were awarded all three marks. Those who were not, usually obtained one or two marks for showing their working.

4 This question was not answered well. Many candidates did not name the person who uses the nuclear radiation. Some gave detailed descriptions of one correct use instead of uses as asked in the question. There is significant confusion involving X-rays, CT scans, MRI scans and ultrasound as examples of nuclear radiation. The candidates who were awarded three marks wrote fluently and clearly about the uses of nuclear radiation.

5 **(a)** The terms compression and rarefaction are not well known. Peak / crest and trough were the most common answers. A significant number of candidates did not attempt to answer these two parts of the question. Only a quarter of candidates correctly identified the wavelength. Many showed it as going to the opposite side of the peak from X and there were a significant number of vertical lines drawn.

5 (b) Many candidates failed to read the question properly and described foetal scanning as another use for ultrasound. The breaking down of kidney stones was the most common response, but taking X-rays was not an uncommon answer.

6 (a) Many candidates believe that the activity of a radioactive substance increases with time. There is also a common misconception that all graphs must start at the origin and this was quoted as the reason for the graph to be incorrect.

6 (b) Half the candidates knew that alpha radiation is used in smoke detectors. An impressive number named the isotope correctly. The remainder usually chose gamma as the radiation.

7 (a) The majority of candidates could describe a satellite as orbiting another body in space. Many were specific in it orbiting Earth. Those who failed to score the mark usually described the job of the satellite instead.

7 (b) Half the candidates answered correctly. The others often listed geostationary as the other type of satellite.

7 (c) Most could write down one use of an artificial satellite. It was pleasing to note that few candidates merely stated weather, without any further qualification, as their answer.

8 (a) Many candidates found it difficult to express their answer clearly. The emphasis needed to be on an object in flight. Answers often merely named the object or the cause of its flight.

8 (b) A quarter of candidates omitted this question. The word trajectory is not well known.

8 (c) The constant horizontal velocity of a projectile is not well understood. Many candidates multiplied by 3, whilst others thought the answer to be 0 or 300. A fifth of candidates did not attempt to calculate the vertical velocity. The more able candidates were sometimes credited with either both marks or one mark for showing some working. Often, the initial horizontal velocity was added to produce an answer of 60m/s.

9 (a) A fifth of the candidates did not attempt this question. Few gained all three marks. There was evidence that candidates had failed to read the entire question properly, as many answers described interference, but not in a way that could be demonstrated.

9 (b) Whilst most knew that satellite signals are collected using a dish, the use of an aerial appeared not to be so well known.

10 (a) Half the candidates correctly identified the path of the light ray into a glass block.

10 (b) Dispersion does not appear to be well understood. The majority of candidates opted for the statement by Ben, that all colours are deviated by the same amount. Celia's statement, that red light is deviated more than blue, was the second most popular answer.

10 (c) Fewer than half the candidates correctly identified a convex / converging lens. Whilst most candidates were awarded one mark for showing rays converging, the second mark for continuity of single, straight rays passing through the principal focus was not gained by the majority. The uses of convex lenses are generally well known, but some candidates elaborated on glasses to state that the convex lens is used to correct short sight.

11 (a) Only a quarter of candidates answered this correctly. There was no common misconception; other choices appeared with similar frequencies.

11 (b) This question was not well answered. The number of correct answers was less than a quarter from a choice of four options. C was the most common answer.

12 (a) Electrical symbols are not well known, particularly the capacitor. The job of the thermistor is well known; the job of the LDR less so. The concept of a generator transferring energy is not well understood.

12 (b) Answers for the use of a variable resistor were often vague, merely mentioning lights. There was some confusion between the job of the variable resistor and the job of a transformer.

13 (a) The majority of candidates could name two domestic appliances that contain motors, although kettle, radio, TV and phone were common incorrect responses.

13 (b) The majority of candidates correctly identified one way to make the motor spin faster. Usually this was to increase the turns on the coil. Other suggestions frequently involved increasing or removing the rubber bands or insulating tape.

14 (a) This question was not well answered. Few know the frequency of AC electricity with answers ranging from single figures up to hundreds of thousands. A common answer was 230. Most believe that danger is the reason for not using DC with transformers.

14 (b) A third of candidates correctly calculated the number of turns on the secondary coil as 6000. Some were awarded a mark for showing their working.

15 (a) The truth table for the NOT gate is generally known, but some candidates had difficulty expressing the meaning of 0 and 1.

15 (b) There were a significant number of candidates who omitted one or both parts of this question. The use of a LED is not widely known and answers often described the position of the light inside the car. The use of the relay as a switch was known only by a handful of candidates.

15 (c) There were some very good answers to this question, but the most common responses were either that the latch allows the alarm to be reset or that it stopped the alarm from continually sounding.

B652/02 Unit 2 Modules P4, P5, P6 (Higher Tier)

General Comments

This higher paper produced a mean mark of 34 / 60 which was comparable with previous June sessions, where the cohorts are large. The mark scheme was designed to reward and stretch candidates where appropriate. There were no 'dead marks' on the paper, but some marking points (e.g. polarisation description in question 10 and refractive index in question 9), were only achieved by the high A* performers.

Overall the differentiation of the questions matched the expected outcomes and there was a wide range of marks on which to base grading decisions.

Sections A (P4) and B (P5) showed higher performance. Section C often caught out candidates. It was here in P6 that significant numbers of candidates were unsure of relays, the isolating transformer and radial magnetic fields. In P5 many had seen ray diagrams, but could not construct them confidently.

Comments on Individual Questions

1 This 3 mark question on static electricity was answered quite well with about 50% gaining full marks. Many got the idea of electron transfer, but with the wrong direction. A few wrote of positive electrons which limited them to the mark for attraction only.

2 This 3 mark objective question on precipitators was answered well with the great majority (80%) gaining full marks.

3 This 3 mark question on Ohm's law was answered well. They were asked to read from the graph to select values and calculate the resistance. Most gained all 3 marks with a few dividing the numbers the wrong way.

4 This was a 3 mark question on X-rays and ultrasound.

4 (a) Quite a lot of references to what x-rays and ultrasound do, as opposed to damage references, were seen.

4 (b) Very few understood the idea of **vibrating** the **particles** of the kidney stone. There were some good high level answers in terms of resonance.

4 (c) Generally well answered, with the only real errors being unqualified references to safety and pain.

5 This question on radioactivity was answered well, although some parts proved challenging.

5 (a) In part (a), many gave confused responses when describing half-life, for example, ideas around 'half the time it takes'. Clearer answers referred to the time it takes for the activity to halve.

5 (b) This graph question on half-life was generally answered well, with over 70% of candidates gaining both marks.

5 (c) Most candidates could work out the correct activity here.

5 **(d)** This question on the results of decay was quite poorly answered. There were lots of answers that seemed to be guesses. In all, 25% of candidates gained this mark.

6 Over half of candidates scored all marks on this nuclear power question.

6 **(a)** 80% of candidates knew the reaction was fission. A few stated fusion although exothermic was probable more commonly seen. Acceptable also was 'chain reaction', which gained [1].

6 **(b)** Frequently candidates' answers were preoccupied with the reactor rather than the generator. Examiners were seeking to reward answers that described heating or boiling water to produce steam [1] which drives turbines [1] that spin a generator [1]. Most gained the marks for steam produced driving a turbine. However, there were misconceptions here; steam, water or heat spinning generators were common. In all, 55% of candidates gained both marks on this question.

7 The majority of candidates scored all 3 marks on this projectiles question.

7 **(a)** About half realised the velocity would remain at 30 [1].

7 **(b)** A third of candidates could not do this calculation. Over 50% though, were completely successful, and gained both marks.

8 This satellite question was answered completely correctly by half the candidates. It discriminated well around the grade C boundary.

8 **(a)** **(i)** This question was answered well by 90% of the candidates.

8 **(a)** **(ii)** About 70% of the candidates could use the graph correctly.

8 **(b)** About 70% of the answers showed that the force of gravity was stronger.

9 This question on optics was a high demand question and it discriminated well at the higher grades for this paper.

9 **(a)** **(i)** This calculation of the angle was a challenge for many. It was quite poorly answered, with many incorrect responses and attempts (common errors seen were 19.1, 20 or 45 [0]). 60% failed to score at all here.

9 **(a)** **(ii)** This question was generally answered well; main errors were vague comments on density and changes in speed. Better answers specified greater density of glass [1] and reduced speed [1]. About a third of candidates gained both marks here and a third gained [1] mark.

9 **(b)** There seemed to be an insecure understanding of ray diagrams. Less than 30% of candidates could draw two correct rays. Common errors were to draw a line from the top of the object through the first focal point and straight through the lens.

10 This question on interference and polarisation contained a common part (a) (grades C and D), with the remainder being all high performing questions.

10 **(a)** This interference question was shared with the foundation tier, but even on this tier only about 30% of candidates gained all 3 marks. Common ways of scoring was for answers to show two sources of waves [1], the type of wave [1] (usually sound or water) and the interference effect or explanation [1]. Many became confused with noise gained by signals or radio masts.

10 (b) (i) Only about 10% of candidates could describe polarisation as vibrations in one plane [1] only.

10 (b) (ii) 20% of answers showed that sound could not be polarised because it was a longitudinal wave [1].

11 This question covered car crashes and momentum from the P5 unit.

11 (a) Around 45% of candidates correctly stated that the passengers would carry on moving when a car stopped abruptly [1]. Some thought that passengers would be 'catapulted'.

11 (b) Most candidates (50%) got the idea of momentum change/increase stopping time/force reduced, but rather fewer (20%) could relate this to the idea of reduction in the rate of change of momentum.

12 This question on motors was answered in all parts by most candidates. Clearly the latter parts were more challenging for most. There was still some confusion with generators although this was less evident than in previous sessions.

12 (a) (i) Generally well answered, with the vast majority of candidates getting at least 2 marks.

12 (a) (ii) Answered well by 80% of candidates, with the common errors referring to stopping or the slowing down or speeding up idea.

12 (b) Most candidates attempted this, but few could answer this question at all. Those who scored points (20%) had the basic idea of curved poles, but few had any idea of the field at 90 degrees to the wire.

13 This question on transformers showed a good range of marks. It was generally answered well.

13 (a) Most candidates gained both marks here.

13 (b) This demanding question discriminated well at the two highest grades. It was poorly answered by most and many did not understand that the idea of increasing voltage means more current. There was also confusion about resistance and its role in heat loss. The connection between power and the square of the current was only secured by the very best candidates. Less than 10% scored all 3 marks.

13 (c) (i) Quite poorly answered. Some had confusion with double insulation or the danger of wet hands.

13 (c) (ii) Very well answered with most candidates knowing the number of turns was the same [1].

14 (a) The Ohm's law calculations were generally answered well with both correct [2]. Many candidates however, failed to secure a third mark by omitting the higher resistance – low current idea [1].

14 (b) 70% of candidates got both truth tables correct.

14 (c) The relay, as in previous sessions, proved to be the undoing of many. These two questions were marked together as good answers to both could appear in either part. This seemed fairer to candidates. However, the relay itself was poorly understood. Many confused it with a latch circuit.

B655 Can-Do tasks and report on Science in the News

The reports sent for moderation in this, the final year of this specification, were of a similar standard to recent years. Most centres applied the criteria appropriately and as a result the majority of centres had their marks confirmed. There are one or two places where centres consistently applied the criteria generously. Some centres still seem to have ignored the advice given in previous reports about the application of criteria.

There were significantly more arithmetical errors this year and often these were reducing the marks of the candidates. At least one centre, for example, failed to add the Can Do tasks marks to the total.

Centres should be assured that it is the role of moderators to support the marks given by the centre whenever possible. Annotation of the sample, to show clearly where marks are awarded, helps considerably in doing this.

Administration

Centres coped well with the system of selection of candidates, but sometimes the delay in sending in marks to OCR slowed the process. The Jubilee holiday also slowed down the process. As a result, some samples were late getting to moderators. Centres are reminded that completed CCS160 forms are necessary and not sending them also delays the process. Not putting centre and candidate numbers on the work, wastes more time in moderation and increases the risk of candidates being given wrong marks.

Supervision of candidates

Centres are reminded that candidates can only bring in copies of their sources to the supervised session. They must not prepare the reports beforehand and then copy them out. This is tantamount to drafting and redrafting which breaks the rules. Many candidates word process their reports. They should not have access to the Internet when they are writing their reports and should not have their sources electronically. Some candidates paste in large amounts from websites or paste in graphs from websites. Pasting in text alone from websites is of little value and pasted in graphs have no value.

Can do tasks

These were introduced to ensure that candidates entering for Science would have some practical experiences and credit could be given for this. It is disappointing that many candidates, who can score the maximum of 24 marks on Can Do tasks, can do little or nothing on Science in the News. A 3 mark Can Do task was intended to be challenging if done properly.

Science in the News

Every year new tasks have been added, but still centres choose tasks which have been available from Year 1. Some centres say it is because they have marking schemes for these tasks and so they prefer to use them. There should not be marking schemes and the reports should be marked against the criteria. With the new Controlled Assessments, the tasks will change every year and old tasks cannot be used. Marking these against the criteria is essential.

Quality A

This is about researching and continues to be important with Controlled Assessments. It is not about the number of sources, but the way they are used in the report that is important. For 4 marks there must be at least two fully referenced sources which are used in the report. Too many centres, having awarded 4 marks correctly, go on to award 6 marks when there is no real attempt at a balanced report. The aim of a Science in the News task is to get the candidates to look at both sides of a question equally and then by the end of the report come up with a reasoned answer. It is not unusual for the candidate to give the answer in the first sentence or for most of the evidence to point one way. This is not balanced.

Quality B

There is still the problem of candidates not identifying trends and teachers not being able to distinguish a trend from a fact. This will continue to be a problem in Controlled Assessments. Without a trend, irrespective of any attempt at processing, the mark is zero. For 4 marks there must be two trends stated and some basic processing which might involve changing data from one form to another eg table to graph, fraction to percentage etc. Still centres award over 4 marks when there has not been further processing to reveal additional information. Just plotting another graph does not match what is required as it is not finding out further information. Plotting an apparent anomaly on the graph drawn for basic processing again is not creditworthy as further processing to reveal additional information has not been carried out. Candidates should decide for themselves what further processing they should do. They should not be told what to do for further processing.

Quality C

As acknowledged in the recent publication on nomenclature by The Association for Science Education (ASE), the use of the terms reliability and validity within Science in the News does not match the way they are used in scientific investigations. Here it is a more everyday use of the terms. For 2 marks the candidate needs to comment upon the quality of information. However, for 4 marks there must be a comparison of likely reliability of sources which identifies, with some explanation, the most and least reliable. Sometimes candidates refer to usefulness of sources or order of preference of sources. These are not the same as reliability. To go higher there should be a consideration of the reliability and validity of data. With Controlled Assessments candidates do not have to consider the reliability of sources they use for Research.

Quality D

Here candidates consider the social, economic and environmental aspects of the topic. They do not have to consider all three, but there must be some depth in their responses to support high marks. They must also include correct and appropriate Science.

Quality E

This is where the candidate uses all their resources to come to an answer to the question. Without reference to sources, the maximum mark for an answer with a reason is 2. For 3 or 4 marks the candidate must show where the sources have been used. Only if the candidate considers the relative significance of the sources in coming to an answer, can a mark above 4 be considered.

Quality F

It was usually possible to support the marks awarded for this Quality. The only problem comes when the candidate has word processed the report and pasted in sections from sources. Marks can only be given for what the candidate has written themselves. If short sections are pasted in they should be highlighted.

The Skills Assessment associated with Gateway Science was intended to give candidates an opportunity to study a scientific question and with research come to an individual answer to the question. It is pleasing to read the balanced arguments of the better candidates.

B656 Research Study, Data Task and Practical Skills

General Comments

This is the final Principal Moderator's report for this specification.

Over the last five years the performance of candidates has steadily improved as Centres came to realise what was required and developed strategies to develop their candidates' performance. It has been a successful mode of assessment some aspects of which are retained in the new Controlled Assessment tasks.

Skills and strategies developed for the Data Task and Research Study still have some validity in the new form of assessment as exemplified below.

Research from identified sources in response to given topics is clearly common to both assessments.

Planning an investigation is also common though significantly more detail is required in the plan for the new Controlled Assessment than was required in the answer to Q5 in the Data Task.

'Interpreting the data' and 'Processing data' have much in common though more is required in the latter in terms of treatment of uncertainty.

'Analysis of the data' and 'Analysing and interpreting' are also similar though again the latter is complicated by the requirement to consider secondary data. This consideration makes assessment of validity easier in the Evaluation section.

Evaluation is common to the two assessment schemes. Though the criteria are not identical, they are very similar.

The sections on conclusions also have their similarities with the addition of a link back to the research in the Controlled Assessment version.

Centres intending to undertake Gateway Controlled Assessment for the first time next year are encouraged to read the Principal Moderator's report for B713.

Data Task

A: Candidates usually showed ability in this quality. Graphs were correctly plotted on axes which were appropriate though sometimes units and titles were missing. The main problem found was graphs which were rather too small either because axes were inappropriately scaled or because the area of the grid covered was too limited.

B: Marks of four in this quality were common reflecting the ability of candidates to undertake simple processing such as averaging and to describe the basic pattern observed. Justified marks of more than four were rare as few candidates undertook significant further processing. Where Centres had provided hints as to what might be attempted, this was not often successful as candidates did not appreciate the reason for the processing and, thus, failed to reveal any additional information.

C: Candidates still find difficulty in addressing both data and method in this quality. Answers which examined the method in detail without considering the data were not worth much credit. The best way to cope with this quality is to start with the data and proceed to explain how the method affected the data described. There was some improvement in the performance of candidates in this quality.

D: Poor conclusions did not link with the data produced during the task and did not adequately use scientific explanations to explain the patterns found. There was also a problem with candidates miss-remembering explanations which they had been given in advance of attempting the task. Good answers were given by candidates who understood the science behind the investigation and who explained it by linking their explanation to results obtained.

E: It is important to realise that the experiment described must answer the question posed. Alternative experiments scored few marks. In order to score four marks the experiment must be described in sufficient detail to allow it to be performed by a third party. The variables and how they will be controlled/measured must be there as must a range of values to be used. Without a sufficient plan, answers to the second part of the question could be given no marks.

Research Study

A : Over the years, candidates have become better at scoring marks for this quality. In many Centres most candidates scored well with answers to all five questions clearly referenced with their sources. The sources were referenced either with a full URL or with sufficient details of a book and author.

B: Again the performance of candidates seems to have improved over the life of the specification. Candidates are including some science in their answers and even where this is copied or paraphrased from a source it is worth some credit if it is relevant. The best answers were where candidates had internalised the science and then used it to explain their answers to the questions.

C: Similarly candidates were, for the most part, able to relate their answers to the topic of the study through exploring areas on the specification in more depth or in explaining links to connected everyday topics. Again the best answers were those in the candidate's own words making use of information gleaned from sources.

D: Centres were usually quite accurate in awarding marks for this quality and it was quite rare to have to change them. Where this did prove necessary it was because there were many 'quotes' from sources which were not in the candidate's own words. Only the candidate's own work can be given credit for QWC.

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