OCR
RECOGNISING ACHIEVEMENT

GCSE

Physics B

Gateway Science Suite

General Certificate of Secondary Education **J645**

Examiners' Reports

June 2011

J645/R/11

Oxford Cambridge and RSA Examinations

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OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

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

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General Certificate of Secondary Education

Gateway Physics B (J645)

EXAMINERS' REPORTS

Chief Examiner's Report

Several examination sessions for these papers have been set now, and centres are preparing their candidates thoroughly. Sometimes, though the contexts in which questions are set can disorientate candidates as they try to apply their knowledge and understanding. This is more often seen in higher demand questions.

There will be up to 15 marks available on a paper (60 marks) for short prompted responses. These are often 'choose from a list' type questions. The distracters in these questions are devised to test knowledge rather than to 'catch-out' candidates. Sometimes two answers are asked for but candidates often only give one response. Also, occasionally, the question is not attempted, perhaps because there is no answer line. At the end of the exam it is a good idea for candidates to use any remaining 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 are, as a rule, being completed increasingly well. In most cases candidates 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 formula too. The usual errors are:

- missing decimal points from one of the input values (e.g. 15V rather than 1.5V);
- apparently forgetting to bring or not using a calculator.
- dividing numbers the wrong way - irrespective of the division it is tempting for candidates to put the smaller number 'underneath the line', so, for example, if the correct division is 3 / 6 which = 0.5 many will incorrectly divide 6 / 3 to get 2.

Centres should remind candidates that scripts are scanned as black and white images, so the use of coloured pens is not recommended. When candidates' answers will not fit in the designated area, a sensible approach is to indicate that 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.

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

General Comments:

This was a small entry paper with approximately 1100 candidates. The mean was down on last year which may be due to two factors: firstly, a reduction in the number of high scoring candidates entered for the foundation tier and secondly a slight increase in the number of questions requiring more than a one word answer. No candidate scored above 55 and less than 1% scored above 50 marks. At the other end of the spectrum only 7 candidates scored less than 10. All questions scored and there were no "dead" marks. Candidates should be reminded to show all their working in calculations as there are working marks that can be awarded when an arithmetic error occurs in the final answer.

Question 1

(a) Most candidates were able to attempt the question and the majority were able identify the radiation causing sunburn as ultraviolet in part (i) and knew how sunburn can be prevented in part (ii).

(b) This proved surprisingly difficult for candidates. Few candidates identified infrared as the radiation in a toaster (microwaves was the most common answer) and only slightly more knew that water and fat were the substances in food that absorb microwaves.

(c) Over 80% of candidates were able to correctly identify the wavelength in (i) as letter B. Part (ii) proved difficult with only about 1 in 10 candidates able to complete the sentence correctly. Examiners accepted air, space, or vacuum as the answer. In (iii), the majority of candidates correctly calculated the speed of the wave.

Question 2

(a) About half the candidates were able to score full marks on this question. Many of the candidates were able to complete the table correctly but significantly fewer candidates were able to give a convincing explanation. Candidates were instructed to use the table and examiners were looking for a direct comparison such as double glazing saves £300 each year whereas cavity wall insulation only saves £100 each year and loft insulation £40.

(b) Candidates found it difficult to explain that cavity wall insulation had the quickest return on money or that, as there was little money, double glazing was too expensive and cavity wall insulation was next best in terms of money saved each year.

Question 3

Three bullet points were provided to assist candidates in their answer to this question. Despite this guidance only about 50% of candidates were able to answer the question correctly. A common incorrect answer was that the temperature of the water increased until it started to boil showing that candidates had not read the question. The question could have been answered by three brief phrases about the heat energy supplied, the temperature of boiling water and the temperature of the potatoes.

Question 4

(a) This was a question about types of signal. Only the more able candidates were able to correctly answer part (i) but in part (ii) the majority knew that analogue was the other type of signal.

(b) The majority of candidates knew that a digital signal was pulsed and correctly chose answer B. By giving "no wires" as an advantage for wireless technology in the question many candidates struggled to come up with an alternative answer. Examiners were looking for answers such as portable, convenient, can be used away from the device e.g. car door locks, TV remotes etc.

Question 5

Most candidates gave the correct answer 'cold' in the first sentence but struggled with infrared as the answer to the second sentence.

Question 6

(a) Most of the candidates, including three-quarters of candidates graded F and G, correctly identified the 3 correct statements.

(b) Here, however, only about 10% of all candidates were able to explain direct current. The majority of candidates incorrectly thought that 'direct' described the route that the current took from the source.

(c) Here only about 10% of candidates correctly identified the Sun as the source of energy to make air move.

Question 7

(a) In (i) the majority of candidates was able to correctly name a fossil fuel but in part (ii) the majority of candidates thought carbon monoxide was given off in fermentation.

(b) Few candidates knew that transformers change voltage (many thought they changed ac to dc) and in part (ii) there was a lot of misunderstanding about the National Grid.

(c) This was answered correctly by most candidates.

Question 8

(a) Examiners were looking for the idea that stars were very hot and give out light and that there was nothing in the way between the stars and Earth. The most common error was that stars reflect light down to Earth. Only about a third of candidates answered this question correctly.

(b) Most candidates answered correctly although there was a significant number who could not think of the extra things needed for a manned spacecraft. Examiners were looking for items such as food, water, oxygen etc.

(c) Approximately half of the candidates were able to give two other uses for artificial satellites.

Question 9

(a) This was answered reasonably well by candidates who knew it could cause cancer or damage cells. The remainder of the question proved difficult for the majority of candidates.

(b) Examiners were looking for ideas such as limit exposure, handle with tongs, lead screens.

(c) Few candidates knew about ionisation.

(d) Few candidates were able to describe how to dispose of nuclear waste.

Question 10

This question was on forces and motion and was answered well by the majority of candidates.

(a) and (b) Most candidates knew that reducing friction increased speed and reduced the amount of fuel used and that the front of a ship was wedge shaped (or similar wording).

(c) Candidates correctly stated that at constant speed, thrust = drag.

Question 11

(a) Candidates identified distance and time as the quantities to be measured

(b) Candidates knew that a speed camera takes two pictures to see how far a car travels in a fixed time.

(c) Candidates stated that a change in speed is called acceleration.

Question 12

(a) About two thirds of candidates chose the correct definition for work.

(b) The calculation proved a little more tricky than normal with a significant number of candidates forgetting to multiply the work by 20 to get the total work done per minute.

(c) Whilst the majority of candidates answered correctly, a significant number got them the wrong way round (0 marks) or wrote the same answer in each to ensure 1 mark. There were very few candidates who chose chemical, geothermal or static as their answers.

Question 13

(a) The majority of candidates correctly linked the distance to the explanation although a significant minority had extra lines so that each box had a line attached.

(b) Less than half the candidates correctly gave the word 'force' to complete the sentence.

Question 14

(a) The majority of candidates did not describe what happens after the air bag inflates. Instead they described why an airbag is used i.e. to prevent a person hitting the windscreen. Candidates should be advised to read the question carefully. Examiners were looking for answers such as: it changes shape, becomes compressed, energy is absorbed, injury is reduced.

(b) Most candidates gave seat belt as a correct answer

(c) Few candidates were able to give a correct answer for a safety feature that helps avoid an accident. Examiners were looking for answers such as: electric windows, adjustable seating, paddle shift controls etc.

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

General Comments

Candidates performed well in the paper; centres had clearly done a thorough job of preparing them for the examination. The standard was generally high with marks above 50 quite common, the top mark being an impressive 58. The mean mark was higher than the examination in January 2011. As in previous examinations, candidates performed very well in the questions involving calculations, with the exception of Q7(b)(ii). Candidates could also link ideas together to answer longer question such as Q1(a) and Q6(c). There was no evidence of shortage of time with this paper and no rubric problems. The questions were clear and there was no evidence that candidates did not understand what was required of them. No incomplete scripts were viewed indicating that there were no time constraints on the candidates.

Question 1

(a) Full marks were often gained although many candidates scored two marks from three correct statements because they did not explain the kinetic energy increase clearly enough to gain the third mark. There were many excellent answers that covered all the points in the mark scheme. Most candidates gained the 'reflection of waves' mark although weaker answers used 'bounce' and/or the reflection of heat. Some candidates thought that the food cooked from the inside out and referred to waves penetrating 1 or 2 cm into the food, presumably they were confusing infrared waves with microwaves. Most candidates gained the conduction or convection mark; whilst there were many good descriptions of conduction, those who did not gain this mark did not clearly explain about kinetic energy or vibrations passing on from one particle to the next. There was some confusion as to whether infrared or microwaves were being used in the grill and whether infrared was used to give energy specifically to the water molecules. There were vague statements about heating from the 'outside in' rather than direct references to the surface of the food. The mark for increased kinetic energy was not always achieved with candidates failing to refer to extra kinetic energy or more movement or vibration. There were some answers that described the infrared waves 'denaturing the food particles'.

(b) Most candidates could answer this question very well, but common misconceptions were that:

- the energy travelled faster
- more waves arrived per second so cooked food cook quicker
- the waves penetrated further into the food.

Others merely gave a description of 'higher frequency'.

(c) (i) This mark was gained by the vast majority although 20 (restating the SPF) or 26 (adding 6 minutes to the SPF) were common errors in wrong answers.

(c) (ii) Both marks were awarded to most candidates with 'reflect' the error in the first part of the answer when only one mark was gained.

(d) Again, full marks were usually gained although very few candidates used standard form and their presentation of the zeros in their answer was sometimes unclear. Centres need to improve candidate's ability to correctly represent answers with this order of magnitude. Some candidates divided the frequency by 10 to score zero whilst a few made transcription errors after a correct start and only scored the 'working' mark.

Question 2

(a) Almost all candidates achieved the mark for correct calculations and completion of the table; a few then chose not to make a comparison and simply repeated statements in the stem of the question. A minority followed a correct table with 'No' and did not gain the second mark.

(b) Most candidates used the correct idea of lowest payback time. Weaker candidates referred to heat loss from the house or how cavity wall insulation reduced heat transfer whilst others merely wrote about it being 'cheap' or 'the second cheapest'.

Question 3

The maximum of three marks was scored by less than 20% of the candidates. For the first answer, 'chosen' was very infrequent and 'arbitrary' was rarely seen in the responses, the most common answer being 'centigrade or oC '. The term 'absolute' was known by the most able candidates but 'joules' was often the response offered. Errors in the third response were to omit 'inter' or to give covalent or hydrogen as the answer.

Question 4

(a) Although over 80% gained the mark, incorrect answers seen included two numbers other than 0 and 1, 'horizontal and vertical' or 'strong and weak', indicating poor grasp of what constitutes a digital signal.

(b) There were many excellent descriptions of noise being filtered out, multiplexing and better output quality. Common errors were 'less interference' and reference to signal quality without mention of 'output'. Many candidates did not show of an appreciation of noise not being recognised or filtered out, often thinking incorrectly that digital signals did not pick up interference or noise. Answers referring to tuning of radio stations were rarely given.

Question 5

Despite this looking a straightforward question with a list of prompts, only the best candidates gained both marks. 'Temperature' rather than 'density' in the convection part and 'container' or 'metal' for medium in the last space were common incorrect answers.

Question 6

(a) This was quite well answered, but too many answers stated 'wind' (or less often 'solar') rather than 'kinetic' in the first part.

(b) Whilst most answers were correct with good descriptions of direct current, weaker answers stated that direct current went straight to or directly to where it was needed.

(c) This proved to be a question with plenty of stretch and demand which resulted in some excellent answers that succinctly included the entrance of light or infrared, radiation absorbed and re-emitted infra red not being able to pass back through the glass. Poorer answers were often too vague although these candidates usually gained the first marking point for radiation entering through the glass. Many candidates went on to say that heat was absorbed by objects.

Few referred to longer wavelengths or lower frequency being (re-)emitted. However, it was a common feature of responses that did not score the third mark not to refer to the idea of 're-emitted radiation from objects in the room'. Poor answers sometimes mentioned the greenhouse effect without adding an explanation of what it was. A small proportion discussed solar water heating panels and gained partial credit. A very small number of answers were constructed around ideas of photo (voltaic) cells.

Question 7

(a) This was a question that the majority answered with ease. Occasional errors were selecting carbon monoxide or propane.

(b)(i) Both marks were gained more often than not in part (i); candidates are comfortable with relatively straightforward calculations like this one. Occasionally a correct start was spoilt by incorrect multiplication. The calculation in (ii) was not as well done. Many candidates found the conversion of 9W to kW too difficult and an incorrect answer was given. The style of the question (often costing calculations have been asked in the past) made one mark answers for correct working rare (e.g. very few gained the '0.009kW'' mark').

Question 8

(a) There was a low success rate in this part of Q8. Common answers were; 'becomes an ion' (presumably prompted by the information in part (b)), 'nuclear radiation' and 'alpha' or 'gamma'.

(b) Most gained the mark, often with a good explanation of how the particle becomes charged. A few answers stated that all electrons were removed or merely used the 'unstable' idea from the previous part of the question.

(c) This question was successfully answered by most candidates although many gave 'containers' without reference to sealed or specifying the material of the container. Very few candidates gave 'reprocessing' as an answer. When answering in terms of burying underground, the word 'deep' was often omitted. Most answers in terms of putting into landfill sites failed to specify 'low level waste' whilst some thought that pumping it into the sea was acceptable.

Question 9

In answers that did not gain full marks, 'gravitation field' was often given instead of 'magnetic field'. Atmosphere or ionosphere were the correct answers seen most often, whilst a named gas was never seen in an answer. Few stated 'gamma' rays. Despite the simple structure of the question, it provided good discrimination.

Question 10

(a) Candidates should be encouraged to use 'elliptical' rather than 'oval'. A small number of answers gave 'circular'.

(b) The mark was usually gained but reference to planets or just 'the Sun' with no mention of gravity were the most common wrong answers.

(c) Most candidates gave good descriptions of 'close to the Sun', poor answers referred merely to the comet 'moving towards' the Sun. 'Close to a planet' or a named planet (either Earth or Jupiter) were also errors in responses that did not gain credit.

Question 11

(a) Candidates showed a good grasp of balanced forces, a very high proportion correctly selected the first box in the list; the second and last boxes being the less frequent choices of some candidates.

(b) The options for the first mark were not regularly awarded as many answers just referred to increased weight or mass having effect on the ability to move forward. Some answers were about the engines not being able to supply the thrust to maintain the speed. Only a minority of candidates realised the answer was about more surface being in contact with the water whilst very few appreciated that the boat would sit lower in the water. A significant number of answers included use of F = ma because the mass had increased and some thought more cargo would create more air friction. However, many managed to pick up the second mark simply for 'increased drag'.

(c) Many answers of 'it increases' were seen. Not all candidates stated that as speed increases, drag increases, whilst a significant minority stated the inverse relationship (i.e. more speed less drag).

Question 12

(a) The overwhelming majority of candidates gained both calculation marks. Some started correctly but then failed to do the division correctly.

(b) There was a very high success rate in this part of the question, although centres should stress the need to draw straight lines with a ruler. Some weak efforts at drawing a straight line were too poor to gain credit. Obvious curves were drawn by some candidates, as well as horizontal lines and the occasional three section line with positive gradient / horizontal section / negative gradient.

The latter answer was presumably due to confusion with speed-time graphs as these candidates invariably answered in terms of area under the graph in the following part of the question. In (ii), some more able candidates stated 'from the gradient' or 'calculate the gradient' although there were a lot of good descriptions of selecting a point on the graph (or using the total ranges in the graph) and calculating distance ÷ time, but many did not refer to the graph at all, merely stating 'calculate distance ÷ time'. Weaker candidates answered 'work it out' without stating the appropriate equation.

(c) Although there were some excellent answers in terms of velocity, there was a range of incorrect answers, but the most common was basically that as the acceleration of the car was constant, so therefore the speed was constant. A number of candidates said that the acceleration was balanced by drag or the car was going uphill. Some responded in terms of terminal speed being reached.

Question 13

The final calculation on the paper was generally well done and most candidates scored both marks. A minority did not appreciate the significance of 20 'chin-ups' and gained a single mark for a calculation resulting in an answer of '9'.

Question 14

(a) Usually the mark was awarded, with alcohol and distractions being the most common answers. A few stated 'speed', neglecting to include the idea of 'increasing' or 'higher'. A sizeable number gained the mark for answers about 'distractions'.

(b) Some very good responses were seen that went quickly to the idea of reduced friction between two braking surfaces. Weaker answers simply referred to the brakes not being effective or efficient. Many that did refer to friction being reduced often went on to say friction between road and tyre. Many candidates did not mention two appropriate surfaces; details of the braking system were not expected. Few gained the 'less retarding force or braking force' mark. The final marking point about conversion of kinetic energy was infrequently awarded, candidates either omitting the conversion idea or writing just about 'energy'.

(c) As in Q14(b) some very good answers were seen that went straight to the point of more kinetic energy to be transferred or it being quadrupled when the speed doubles, and then linking that to the quadrupling of the braking distance. Weaker candidates as expected did not refer to kinetic energy or braking distance being quadrupled and just restated information from the question. A significant number of candidates thought that at the highest speed there was a greater force pushing the car forwards and that this had to be overcome by the brakes. Some answers correctly stated that the kinetic energy or braking distance would quadruple whist failing to make it clear the these events were linked to speed doubling. When referring to kinetic energy, many candidates understood the idea of greater kinetic energy at higher speed but did not refer to more energy being transferred.

Question 15

(a) There were some excellent higher level answers with full explanations in terms of increased stopping time or distance, reduced acceleration and reduced force. Unsuccessful answers referred to the impact or force being absorbed. Few candidates gained a mark for 'reduced injury' or 'saves lives'. There were some answers relating to a crash which were not clearly linked to the airbag.

(b) There was a very high success rate in Q15(b) to finish the examination: 'seat belts' was by far the most popular response followed by 'crumple zones'. Occasionally, the mark was not gained because the answer was about a feature that was meant to reduce the chance of a crash.

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

General Comments

Overall, the paper produced a good spread of marks from the 1500 candidates. The mean mark for the paper was similar to previous examination sessions. There was little evidence that candidates had been entered inappropriately.

Candidates seemed to have sufficient time to answer the questions although there was a disappointing number of instances where questions had not been attempted, notably questions 1(b), 1(c), 9(a)(ii), 10(b) and 13(a).

Many candidates were able to answer calculation questions correctly.

The paper discriminated well over the grade range C to G and candidates were given adequate opportunities to demonstrate what they knew and understood.

Comments on Individual Questions

Question 1

(a) Most candidates could identify uranium as a source of energy.

(b) There was confusion about how an isotope could be made radioactive. Common misconceptions included adding radioactive material or leaving it close to another radioactive isotope.

(c) and (d) Most knew where radiation originated and the use of alpha radiation in a smoke detector.

Question 2

(a) Most candidates correctly identified types of charge as being positive and negative.

(b) There was confusion about the possible outcome of removing the copper wire during refuelling. Some candidates provided answers regarding the rate of flow of fuel.

(c) There was confusion about the beneficial use of static electricity.

Question 3

(a) Many candidates provided a simplistic answer that current is caused by a flow of electricity, but most answered 'electrons' or 'charge'.

(b) Almost all candidates calculated resistance correctly. Common errors involved multiplying or adding.

(c) Candidates who knew that the fuse blows, often failed to provide a clear reason for it doing so.

Question 4

(a) Most candidates could identify the centre of a compression.

(b) The identification of a wavelength was often confused. Many candidates suggested the next wavefront.

(c) Most knew two uses of ultrasound in a hospital. Some did not suggest different examples, quoting two examples of scanning.

Question 5

(a) There was confusion about which types of radiation are part of the electromagnetic spectrum. All incorrect answers were forthcoming.

(b) Many knew that radioisotopes decay with time but did not mention how this affected the activity.

(c) There continues to be confusion between gamma radiation, X-rays and ultrasound as the suggested uses for gamma radiation indicated.

Question 6

(a) Those who did not identify the other type of satellite as natural, often referred to its orbit instead as being 'polar' or more commonly 'geostationary'.

(b) Many referred to uses of artificial satellites when asked describe what one was. Most knew of a use. Some repeated the question by referring to television or telephone transmissions.

Question 7

(a) and (b) There was confusion about both relative and average speeds. Many thought that cars approaching each other would have a lower relative speed and that an average speed meant a constant speed.

(c) Confusions arose from an incorrect choice of equation from the list provided.

Question 8

(a) Most candidates could identify 'trajectory' as the path of the arrow. Many thought the shape to be either circular or elliptical.

(b) Most understood the transfer of force from the string to the arrow.

Question 9

(a)There was confusion over which coloured light is deviated the least. Many candidates chose orange and green as well as blue. Few could explain why colours dispersed. Most answered in terms of differing amounts of refraction and did not mention change of speed.

(b) Most correctly identified the diagram showing refraction into water.

Question 10

(a) Most candidates could identify the focal length of a lens.

(b) Many did not know that converging lenses are convex.

(c) There was some confusion between long and short sight which meant that many did not score the mark for the use of the lens.

Question 11

(a) Many candidates find the topics of diffraction and interference difficult to understand. Many wrote that radio waves were refracted around or passed though the hill.

(b) Many who answered realised that waves met but did not go on to state that they added together to reinforce or cancel.

Question 12

(a) Most candidates could identify the two appliances which contain a motor. Many believe that a kettle or a lamp do so.

(b) Most candidates scored the marks but there is some confusion between motors and generators.

Question 13

(a) Few candidates used the term 'isolating' when describing the transformer in a shaver socket.

(b) Most candidates answered some of this part. Many failed to identify both the type of transformer and what happens to the voltage at each point.

(c) An erratum notice was produced for this part, changing the voltage values on the diagram of this step-down transformer. Most candidates correctly calculated the number of turns. Many started their calculation correctly by calculating a turns ratio but then provided that as their answer. Some candidates did not get (or did not act upon) the erratum. This was clear when marking and so the work of these candidates was marked based on the original data.

Question 14

(a) A surprisingly high number of candidates failed to correctly complete the truth table for a NOT gate. Many could not explain the meaning of 0 and 1.

(b) Confusion about a latch circuit centres around the meaning of latch as a lock.

(c) Most candidates know the job of the diode.

Question 15

(a) Most candidates correctly identified the four circuit symbols. Many reversed the meaning of power supply and battery. Many identified the switch as a diode.

(b) Many failed to fully explain the use of a variable resistor by just writing 'lights'.

(c) Many described the shape of the graph instead of suggesting why it is the shape it is.

(d) Few candidates managed to complete both sentences correctly. Many chose higher and lower in either order.

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

General Comments

The paper seemed to be of the correct length with very few candidates appearing to run out of time. The quality of answers was generally good.

Calculations were answered well by most. Calculations involving a change of subject are generally of grade B standard and these tended to discriminate well at the grade C boundary.

There were frequent 'no response' answers from candidates performing at low grade C or D standard. This was the case on the 'wordy' 2 mark questions as many of these were at grade A demand or higher. Often less straightforward calculations such as the transformer one had no responses from these candidates, though they may have been able to demonstrate more clearly their grasp of physics had they taken a foundation paper.

Some questions illustrated a lack of preparation on the candidates' behalf and answers showed quite different outcomes from candidates of apparently similar ability. This was particularly the case in module P6 where the silicon diode and relay questions were answered with clear confidence by some and hesitation by others.

Centres need to be aware that the handwriting of an increasing number of candidates is causing concern. This along with crossings out due to lack of planning of answers can be a problem.

Comments on individual questions

Question 1

(a) Most candidates knew that free neutrons hit the uranium atoms causing the nucleus to split and release energy. The spelling of nucleus and neutron in some answers could easily be confused. Free 'electron' was a popular wrong answer and so also was free 'radical'.

(b) This question was poorly answered by many candidates. The idea of absorbing neutrons was often lacking and some candidates transferred the incorrect answer (electrons) from part (a). Many restated the question and referred to the control rods controlling the speed, temperature or rate of reaction.

(c) Most scored at least one mark for steam driving, spinning or pushing the turbine. Some ignored the fact that the turbine and generator were linked and that one turns the other. Some thought that the steam merely goes through the generator and turbine, and electricity comes out. More than half of candidates scored both marks on this question.

Question 2

(a) This was well answered by nearly all candidates

(b) More than half of candidates had the idea that electrons move from the fuel. Some weaker answers referred to positive electrons moving.

(c) This was answered well by the great majority of candidates.

Question 3

(a) 'Electrons' or 'charge' were popular correct answers with weaker candidates putting 'a flow of electricity'.

(b) This was a very well answered calculation on resistance. It was good to see only very few candidates getting this wrong.

(c) In general, this question on fuses was well answered. Typical incorrect answers described the fuse blowing up because the voltage is too high.

(d) In this calculation, a rearrangement of formula was required. Most were able to do this although it discriminated well at the C boundary with many arriving at the wrong answer of 1.25.

Question 4

(a) About two thirds of candidates described the beta particle as an electron. Some described alpha particles by mistake and others merely described it as a radiation.

(b) About half of candidates got this right and correctly picked nitrogen from the list. Carbon and beryllium were common incorrect responses.

(c) This was a deliberately challenging question aimed at grade A and A* candidates. It discriminated well at A*. Only about 15% of answers gained 1 mark and fewer gained 2. Most wrote vaguely of the shroud becoming less radioactive and that half lives could be used to age it. Better answers explained that radiocarbon was fixed at death or that carbon-14 is in all living things, while few mentioned that the amount of carbon-14 in air is constant for long time or that when living things die, gaseous exchange with the air stops. Other mark-worthy responses related to carbon-14 in material decreasing over time. Most though were confused by or could not sufficiently explain that the ratio (comparison) of current activity (or amount) from living matter to the activity from the shroud can give an estimate of its age. Some referred to lead and uranium or any one of the incorrect answers from 4b.

(d) Just over half the answers were correct for naming a use for beta radiation. Thickness testing was a popular response as was use as a tracer. Some though wrote of tracers for underground pipes which would not work as beta has such a low penetrating power. Some also confused it with alpha radiation and named the smoke detector.

Question 5

(a) In this question on dispersion, about half of answers correctly referred to the colours having different wavelengths, frequencies, speeds or occasionally refractive indices. Rather than explaining dispersion, weaker answers were confined to describing the colours as refracting by different amounts.

(b) Although any reflected rays were ignored when marking, only about 30% of answers drew in a ray along the base of the block. A minority of candidates did not attempt the question.

Question 6

(a) Most candidates gained two marks here for writing about diffraction around the hill (or obstacles). Some named the process as reflection and some described reflection from the atmosphere, which was ignored.

(b) Many got the idea of waves overlapping but did not state an outcome (constructive or destructive). About half the answers were correct and most of these were gained by simple diagrams showing two waves combining to give a bigger wave or no wave at all.

(c) In (i), the idea of less diffraction was correctly given by most, although this was less common in part (ii). The impression was given that if it was 'less diffraction' in part (i) then it must be 'more diffraction' in part (ii). Grade A candidates generally got part (iii) correct (gap size = wavelength). Many poorer answers described making the gap smaller and the wavelength bigger.

Question 7

(a) Very few drew the correct diagram but about 45% used the Pythagoras calculation correctly. It was common to see the numbers either added or subtracted.

(b) About 60% got this higher demand calculation correct.

(c) Only a minority of candidates recognized the inverse square law. Written answers were often poor and lacked scientific terms such as rate or gradient. Some were just confined to the term 'a negative correlation'. Others picked coordinates from the graph but then failed to illustrate anything with them. Some described convincingly the idea of the gradient decreasing and were awarded 1 mark. Less than 30% scored 1 mark here with very few gaining 2. This is a familiar outcome as many candidates do not act on the command word 'describe'. Many try to explain instead and get into difficulties sooner rather than later, and avoid the marking points as a result.

(d) Weather forecasting and spying were popular answers for this well answered question. Common incorrect answers were GPS and mobile phones. 'Communication' was ignored unless the answer was developed to hit one of the marking points.

Question 8

This high demand question on momentum and crumple zones was an intentional challenge to many candidates. Some ideas were muddled and not really connected to momentum at all. The idea of more time affecting the rate of change of momentum was explained with varying degrees of success. Many (about 30%) got the idea of there being a longer time involved but only a few confident candidates went on to relate this to less force and the (rate of) change of momentum.

Question 9

(a) This question on lenses prompted about half of candidates to write about a convex lens and gain the mark. Some of these answers involved focussing but other worthy answers such as inverted or diminished images scored also.

(b) In focussing the lens, many incorrectly answered 'zoom-in' or 'zoom-out'. Good answers (about 40% of candidates) referred to moving the lens away from the film. A common incorrect answer was to make the lens concave.

(c) The idea of a real image was poorly understood by most candidates. About a quarter could describe it as being formed on the film. Many stated 'virtual' as their answer.

Question 10

(a) Some answers lacked detail and did not refer to the speed in part (i). Some thought it was a generator and referred to stronger current etc. Most candidates however got this and part (ii) correct.

(b) Most know that AC or alternating current was produced and that the voltage and frequency would both increase. Wrong answers were usually about the frequency (stays same or decreases).

Question 11

(a) Part (i) was poorly answered as candidates were vague and did not specify what caused the danger and who would be affected. Many talked about dropping the razor in the bath with no reference to the transformer at all. Good answers (about 20% of candidates) described the reduced risk of the user being connected directly to the live mains. Some mentioned there being 'only a magnetic link between user and mains'. In (ii) about 50% of candidates know that the number of turns would be the same; 750, however was a popular answer.

(b) An erratum notice was produced for part (i), changing the voltage values on the diagram of this step-down transformer. The calculation was done well by 75% of candidates. Some candidates did not get (or did not act upon) the erratum. This was clear when marking and so the work of these candidates was marked based on the original data. In (ii), some answers were muddled or contradictory or vague, describing more turns but failing to say which coil they were describing. Over 50% of candidates got it correct though. Many talked about step up rather than step down without describing the construction.

(c) The smoothing effect of a capacitor was given by a third of candidates. Many knew vaguely that it was something to do with storage. Storing electricity was commonly seen.

(d) This deliberately challenging high demand question discriminated well at A*. Marks were available for the ideas that

- holes lack electrons or holes are positive (commonly seen)
- holes 'move' in the opposite direction to electrons
- holes (appear to move) towards the negative
- electrons fill up the holes (commonly seen)

Only about 10% of candidates gained 2 marks here.

Question 12

(a) About half of the candidates gave the correct truth table for the NAND gate.

(b) This 3 mark question on relays gave opportunities for success for about a third of candidates, although it was rare to see answers gaining full marks. Answers were often very muddled and lacking in science. Some described transformers rather than relays. Marks were available for the ideas of

- a small current switches or controls a larger current (most commonly seen)
- logic gate (electronic circuit) has low current output / low power output
- relay isolates from mains for protection of user (often attempted but muddled ideas in explanation failed to convince markers)

Question 13

(a) Some answers related to the shape of the graph. Candidates missed the point that it was due to the change in resistance. About a third of candidates gave the correct answer.

(b) Just under a half of candidates got this LDR question correct.

Question 14

This calculation was done well by 80% of candidates who gained both marks.

B655 Unit 3 – Can-Do tasks and report on Science in the News

General Comments

For teachers and moderators, Science Skills assessment is now well established. However, it is not possible to report any improvements in the average performance of candidates though there is some evidence that the expectations of teachers and centres are higher.

For Science Skills assessment, there are two components: Can-Do Tasks and Science in the News.

The aim of Science in the News is to get candidates to research a scientific issue, looking fairly at both sides, before reporting and finally coming up with a reasoned answer to the question. In some centres candidates do this, but in some it is no more than an essay on the topic giving few opportunities for matching the assessment criteria. Too often this year centres have awarded 6 marks routinely for Qualities A and F with little regard for the hierarchical criteria.

It is possible for candidates use the same piece of Science in the News for more than one specification. However, each specification is moderated separately so if the same piece of work is used, it must be photocopied each time it is used. Marks cannot be just transferred from one specification to another.

It is disappointing that an increasing number of candidates score 24 for the Can Do tasks and nothing for Science in the News. The skills claimed to be shown in completing Can Do tasks are valuable in the Science in the News task.

Centres are reminded that, if a piece of work is resubmitted in a following year, the Science in the News report cannot be added to but new Can-Do tasks can be attempted. If the Science in the News report is not considered to represent the true standard of the candidate a new and different Science in the News task should be attempted.

Administration matters

Administration matters - general

Teachers are required to supply, for each of the candidates chosen in the sample, a breakdown of the marks awarded for the Can-Do tasks together with the marks awarded for each of the six Qualities in the Science in the News task which had been chosen for assessment. For the first time this year the sample was chosen by OCR's Moderation Manager and not the Moderator.

Administration matters – selecting tasks for Science in the News

One of the strengths of Gateway Skills Assessment is that all of the materials which are required for each of the Science in the News tasks are provided by OCR and are available on the secure Interchange website. Some centres have not realised that new tasks are been added each year and it is a pity that over 90% of candidates complete one of the tasks which were in the original batch. It is of little surprise that candidates say the data is out of date.

Centres completing the same task year after year may give the impression that there is only one scientific issue worth discussing. It is worth noting that for the new Gateway specifications, the Controlled Assessment tasks, still set by OCR, will change each year. Teachers sometimes

argue that they use the same task because they have set up mark schemes for the task, but all marking should be against the published generic criteria and so changing the task should not matter.

Administration matters - Supervision of Skills Assessment

One of the strengths of Gateway Skills assessment is that the assessed work is under the direct control of the teacher. This is a good precursor for the new Controlled Assessments which begin in 2012.

All Science in the News tasks are written under controlled conditions so that the teacher can sign the Centre Authentication Form (CSS160) with confidence. Unfortunately, there is sometimes evidence of teachers advising candidates of improvements that should be made before the work is submitted. This is not permitted. Also, candidates cannot bring into the session summaries they have written. They can bring in their research, a bibliography and any graph that they have prepared.

The teacher should give the candidates the OCR stimulus material for a task after the topic has been studied so that they are fully equipped with the background to the task. The teacher may read through the stimulus material and explain any scientific words but they must not give any opinion.

Centres are allowed to use their own writing frames providing they are generic i.e. not specific to the task and the same writing frame must be used for all tasks. There are still a few centres using non-generic writing frames.

There is considerable evidence that candidates do their best when they are given independence to study the topic and look at both sides of the argument. It is common, in some centres, for candidates to be provided with a list of suitable sources. Even if they are fully referenced, this does not automatically give the candidates 4 marks. Sources must be used and not just quoted. It is not unusual to see 10 or more sources listed. This is totally unnecessary as no candidate can use all of these adequately in the report. Telling candidates which are for and which are against the argument is giving too much assistance.

Administration matters – research time

Each Topic requires the candidates to undertake some research for themselves in a period of approximately one week This research could be done in school, either in the laboratory or a computer facility, or it could be done at home, and it is emphasised that the candidates do not need to be supervised during this preliminary research and they do not necessarily need to work on their own. If the preliminary research is done in school, teachers can provide some materials to get the candidates started with their task. However, in some centres the candidates are provided with a complete list of source material for use and the necessary element of choice and selection on the part of the candidate for relevant aspects had therefore been removed.

Administration matters – supervised session

When the preliminary research has been completed, the Science in the News tasks are written up under controlled conditions in the classroom/laboratory. Candidates are required to work independently and, although a time of 1 hour is suggested, the centre may use more or less time as required. If it extends beyond one lesson, the work should be collected in between the sessions and stored securely.

A limit of 400-800 words is also suggested in the specification.

Increasing numbers of candidates use word processors to produce their reports.

Centres are reminded that this is acceptable, providing the centre can ensure

- that no complete or largely complete report is brought into the writing session on a USB storage pen or in any other electronic format;
- no competed report is taken out or e-mailed to another person;
- the candidate cannot access websites electronically either from storage devices or the Internet; the Internet should be off during the writing up session.

If these conditions cannot be guaranteed, it is not possible for the teacher to sign the Centre Authentication Form, and hand-written reports should be used.

Moderators continue to see word processed reports in which the whole report has been pasted in electronically from websites without any acknowledgement, as if it was the writing of the candidate. Quality F marks can only be assessed against work the candidate has written, even if the source is fully referenced.

Evidence of drafting and redrafting of candidates' reports or too much coaching leads to the work not being accepted for moderation and reported to the OCR Malpractice Committee.

Can-Do tasks

Can-Do tasks are an important part of the Gateway Science specification. Carried out well they are motivational for students at all attainment levels. The Tasks ensure that practical science is an important aspect of the course and they can also ensure that ICT is used appropriately.

They are not expected to differentiate candidates above Grade C.

These tasks must be credited for individual work and not for a group of candidates collectively completing a task. All aspects of a task must be completed before credit is given and it is not possible to award 1 or 2 marks for a 3 mark task.

Centres are not expected to provide any evidence for the moderator to support the awarding of marks for Can-Do tasks.

Science in the News

Approach

Since Can-Do tasks will not differentiate above Grade C, it is essential that the necessary differentiation between the levels of attainment of candidates is obtained using Science in the News.

The marking criteria must be applied hierarchically. They can only be awarded when the whole statement is fully matched. There are still some centres trying to use a 'best-fit' principle.

It has always been OCR policy to encourage teachers to annotate coursework. As candidates may attempt several Science in the News tasks, this represents a burden on teachers when, in reality, very little of the work will be seen by a moderator. It is recommended that the emphasis should be given to the need to report back to students so they can improve in the future. When the sample is requested by the moderator, a little time should be spent checking the annotation of the maximum of 20 reports that have to be sent. In particular annotation should concentrate on why intermediate marks (i.e. 1, 3 and 5) have been awarded. The aim of annotation is to provide evidence that the moderator is able to accept in support of the marks awarded by the centre.

It is important that internal standardisation is carried out and the moderator informed of the way in which it has been done. This year several centres had clearly not internally standardised the marks and consequently the rank order was not valid. In such cases the sample has to be returned to the centre, and it is not desirable for teachers, for moderators or for OCR if work has to be returned at the beginning of June to be re-marked. It is possible that the marks of a centre could be reduced if one or two teachers have over-marked and internal standardisation has not taken place.

Quality A (Approach to the Task)

Candidates who do not undertake any research of their own cannot be awarded a mark in Quality A since the use of the OCR source material does not count for research purposes. Many candidates try to use it as a source. However, candidates who do not do any research for themselves, but rely on the OCR source material alone, are able to gain marks in the other five Qualities.

For 2 marks candidates only need to use one source - from a book, newspaper, Internet etc. The source does not have to be referenced.

For 4 marks, however, a candidate must use more than one source. Two sources are sufficient and it helps later in their report if one source is for and one source is against the question posed. It is essential that not only that each of the sources is fully referenced so that it can be checked, but also that it is clearly identified where it has been used in the report.
Without detailed referencing it is impossible to support a match to 4 marks. A long list of sources, even if fully referenced, does not mean the award of 4 marks unless they are used.

For an award of 6 marks it has to be clear that the sources have been used correctly to produce a structured and balanced report. The candidate is expected to have looked equally at both sides of the issue. Centres are reminded that 6 marks is awarded for the quality of the research and how it is used to produce a balanced report, rather than the quantity of research which has been done
Again it is important to say that little credit can be given where large amounts from a website have just been pasted in but not used, even if the work is fully referenced.

It is recommended that candidates attach their preliminary research to the back of the report which has been produced during the supervised session. This will assist the teacher in marking the report since it will save having to go back to the sources to check the information. This preliminary work does not have to be sent to the moderator.

Quality B (Analysis of the data)

The award of marks for this quality is dependent on the candidates actually processing the information/data which they have collected.

For 2 marks the candidate needs to identify a simple trend or pattern e.g. *'….more women get skin cancer than men…*'. It is not sufficient to quote just a fact e.g. *'…7000 women in England get skin cancer…'*. Trends can come from the OCR source material or from the candidate's research. There are always ample trends and/or patterns within the OCR source material. The trends quoted must be correct.
There are still many examples of candidates carrying out processing, even quite advanced processing, without identifying any trend. This is not worth even 2 marks as the mark descriptors are hierarchical.

For 4 marks there must be evidence of more than one trend, although which is the main trend may not be obvious, and some processing should done by the candidate, at a standard approximating to GCSE grade C level. This could be by drawing a graph, pie chart or bar chart

from the data, calculating averages or percentages, or extracting and using data from a graph etc. It is important that the processing is correct. A poorly drawn graph with incorrect scales or incorrect average calculations should not gain credit. Teachers are reminded that, for the sort of data obtained, bar charts are often more appropriate than line graphs.

Few candidates progress beyond 4 marks. This is not surprising considering the hierarchical nature of the mark descriptors. It is not sufficient just to pick out an apparent anomaly in data. To secure above 4 marks, the candidate must do some **further** processing to identify some new information or to identify anomalies. In a few cases it was apparent that a candidate was told to take a particular approach to get 6 marks but did not fully understand what they were trying to do.

Quality C (Evaluation of the data)

There are still some reports where the quality of the data is totally ignored and so a mark of zero has to be awarded.

For 2 marks the candidate needs to make some comment about the quality of the sources used or the data within them. This can be a very simple statement.

For 4 marks the candidate must compare the likely reliability of different sources and explain why one source is likely to be more reliable than another. It is common for candidates to write that the OCR source material must be reliable as it comes from an examinations board. This is not true because, in writing the source material, unreliable sources are used along with reliable ones. The candidate must go back to the reliability of the original sources.

To go above 4 marks the candidate's judgement about reliability of sources must be sensible and supported. They must also consider the validity of the sources.

Quality D (Relating Data to the issues)

Social, economic and environmental aspects of the topic are an important part of the assessment and some Centres did not develop these areas sufficiently with their candidates during the teaching process.

Different Science in the News tasks provide different opportunities for consideration of social, economic and environmental aspects, and it is difficult to link all three of them in some tasks. Teachers should remember that the 2, 4 and 6 mark descriptors are loosely linked to performance at F, C and A respectively. So when awarding 2 marks, teachers should ask whether the response matches the expectation from an F grade candidate. Similarly, performance at C and A can be the evidence for awarding 4 and 6 marks. It is not necessary to cover all three aspects even at 6 marks providing the approach to these aspects is at a suitably high level. For the award of 6 marks, the information must be accompanied by correct science.

Often these social, economic and environmental aspects were diffused throughout reports rather than in a separate section. This does not affect the mark awarded but makes it more difficult for both the teacher and the moderator. There is some evidence that teachers have been more generous in marking this Quality.

Quality E (Justifying a conclusion)

All of the tasks are posed as questions and therefore need an answer. No marks can be awarded where no decision is reached. The aim is that candidates come to a decision as a result of their studies.

For 2 marks the candidate needs to decide *'yes'* or *'no'* and then give a reason. The use of the word *'….because…..'* in the candidate's response is useful but not essential.

For a match to 4 marks, the candidate does need to link clearly their choice to two particular sources.

For 6 marks a candidate needs to decide which source is more significant. Few candidates can do this. It is here that researching sources with different viewpoints becomes helpful.

Quality F (Quality of written communication)

There was some generosity in Centres in awarding marks for this Quality. The use of a scribe to write the report for the candidate could limit the mark that can be awarded.

For 2 marks there could be many mistakes but it would still be possible to read the report.
For 4 marks there should start to be the correct use of scientific vocabulary. Some reports lack scientific vocabulary or it is merely pasted in without understanding. This makes 4 marks insecure.

For 6 marks, there are few errors and a good use of scientific vocabulary.

Some reports had been word-processed and a spell-checker obviously used. Such reports need to be near faultless and to contain scientific vocabulary to award 6 marks.

Summary Comments

The job of moderators is to try to support the decisions of centres whenever possible. Providing the marking is within plus or minus 4 marks of the moderator, no changes are made as the centre is deemed to be 'within tolerance'. Where the marks are outside tolerance and adjustments have to be made, moderators will provide useful reports for centres.

Since the same work can be submitted for Science in the News for Science and separate sciences, the same grade boundaries apply for B635, B645 and B655. Approximately two thirds of the separate science cohorts used Science Skills assessments rather than Additional Science Skills assessments.

B656 Unit 4 – Research Study, Data Task and Practical Skills

General Comments

It is pleasing to note in this, the penultimate report on this specification, that the majority of centres applied the criteria sufficiently accurately as to make any scaling of their marks unnecessary.

Those centres are thanked for their attention to detail and their compliance with the administrative procedures.

There were, however, a significant number of centres where problems still arose and it is to those centres that the following remarks are chiefly directed.

Centres are reminded that it is the job of a moderator to support the decisions of the teachers in a centre wherever possible. Annotation of the work in the sample submitted, to show where and why marks were awarded, greatly facilitates this process. Too often it is not clear to a moderator on what basis a particular mark is decided upon.

Administration

Most centres coped well with the change to the system of sampling. It is hoped that next year the process will run more smoothly for all centres.

Whilst moderators no longer need the MS1 sheets in order to select a sample it is still helpful if these sheets are sent to the moderator either early or with the sample of work (see comments in the section on internal moderation). Along with the MS1 sheets it is essential that the Centre authentication sheet (CCS160) is included. If this sheet is not supplied then marks for the skills assessment have to be withheld.

Each sample of work should have the Skills Assessment Record sheet attached to the front. This is the only way a moderator has of knowing the mark awarded for Practical Skills.

There were too many cases where the marks on the record sheet had been wrongly totalled or where the mark had been wrongly transferred from this sheet to the MS1 mark sheet. Errors like this delay the process of moderation and cause additional work for both the moderator and the centre.

Supervision of candidates

Centres are reminded that, although close supervision is not necessary in the research phase of the Research Study or during the practical part of the Data Task, it is obligatory for the sessions where the written work is done.

Centres have to fill in a Centre Authentication Form. By completing this form a centre certifies that candidates have been supervised as instructed in the board's regulations and that they are satisfied that the work is the candidates' own.

There has been more than one occasion, this year, where two identical pieces of work have been present in the sample requested. There were also a good number of cases where different pieces of work had similarities which seemed to go beyond what could have occurred by coincidence.

Where this occurs and plagiarism has clearly taken place, neither candidate's work will be credited.
If candidates are supervised properly, according to the board's regulations, this should not occur. Please note:

- Candidates are NOT allowed access to the internet during either of the supervised sessions.
- Candidates may not bring any electronic media into a supervised session.
- In the Research Study session candidates may have access to their rough notes and print outs of their research but nothing else.
- In the Data Task session candidates should have access only to their results and the instruction and question sheet for the task.
- Redrafting (producing a second version of the work after teacher correction) is strictly prohibited.

Comments on the assessment of the different qualities

Research Studies

The Research Study assesses the candidate's ability to research a topic and to use the results of that research to answer the questions posed.

Candidates should not be taught the information needed to complete the task. This obviates the need for research and results in very similar answers from all candidates. Marks are rarely very good and candidates frequently do poorly by miss-remembering what they have been taught.

Candidates should write answers to each question separately not write an essay on the whole topic. Candidates following this structure are likely to answer each question thoroughly.

High marks cannot be scored if questions are answered incompletely.

Quality A: Collecting information

There are two common errors in assigning marks for this quality.

Sometimes a candidate is given zero marks because they have given no references. Wrong! They can have two marks if it is clear from their answers that they have done some research.

Sometimes a candidate is given six marks because they have a large number of fully referenced sources in their bibliography. Wrong! This is only worth four marks. For higher marks the sources must be referenced in the text of the study. If sources are linked to the questions five marks are available, if they are linked to items of information within the answers six marks can be awarded.

In summary, it is not necessary to have a long list of sources to gain high marks but it must be clear how the sources have been used.

Quality B: Interpreting information

The key word for this quality is 'information'. Some Research Studies involve the drawing of graphs or other interpretation of data. Doing this, even when correct, does not merit 6 marks.

It is the information in the candidate's research which must be interpreted. Their understanding of the information discovered must be clear from their answers to the questions. Higher marks will be gained from the understanding (interpretation) shown in answers to the later, more open ended questions.

Good answers to early questions followed by poor answers to later questions do not deserve six marks.

Answers copied from internet sites are worth some credit and can be given a maximum of four marks if they are relevant and answer the question completely and appropriately. However, for six marks candidates must demonstrate their understanding by use of their own words.

Quality C: Developing and using scientific ideas

The 'scientific ideas' involved here depend on the topic of the study. Topics are either an extension of an idea which is part of the specification or from an area outside the specification with clear links to science taught in the course.

Whichever is the case, more is expected than a reiteration of what has been taught. There should be evidence that some research has been done and the results should be correctly applied to answer the questions posed. Wrong answers should not be given credit.

It is chiefly in this quality that candidates who have been taught the necessary information usually fail to perform as well as they should.

As in quality B, credit (up to a maximum of four) can be given for text copied from sources, as long as it is relevant and fully answers the question.

Quality D: Quality of written communication

The criteria for this quality are reasonably clear and centres usually get the level about right. However, it should be noted that the consistent and correct use of scientific and technical vocabulary is more important than minor grammatical errors. A perfect piece of English with few if any examples of appropriate vocabulary is worth four. Whereas, a piece of work which is clearly science with appropriate vocabulary, is worth six even if there is the occasional spelling mistake.

Candidates are often given too much credit for the words which originate from a website. Only their own words can be given credit in quality D.

Data Tasks

It is intended that candidates actually carry out the investigation described. Fallback data is provided for candidates who have been absent for the practical session, or whose results make it difficult to detect patterns and so come to a valid conclusion.

Candidates who use fallback data for the second of these reasons should also include their own results. They should use their own results for answering Q3 (evaluation) but the fall back data for their other answers.

All candidates should include a table of results, even if they are using the fallback data. Moderators need to see evidence of the 'simple processing' (usually averaging) before they can give marks for quality B. They also need to check the accuracy of the plotting in the graph.

If a candidate does not perform the investigation they are disadvantaged, especially in answering questions 3 and 5 (skills C and E)

Quality A: Interpreting the Data

Candidates' graph drawing skills are generally quite good and marks of less than four for this skill are rare. Where marks are low it is usually due to small, poorly drawn graphs, inaccurately plotted points and wrongly scaled axes. Any two or more of these factors is likely to result in a lower mark.

Candidates were sometimes given six marks for graphs which were not of sufficient quality. The graph line should be well drawn and not too thick. It should be drawn with a ruler if straight or be smooth if a curve. Graphs should be accurately plotted and on axes with sensible scales. The scale should allow the graph (not just the grid) to occupy at least half of the available A4 space.

A best fit line should ignore 'outliers' but should then have an approximately equal number of points on each side of the line. A best fit line does not always have to go through the origin, indeed sometimes it should not.

Quality B: Analysis of the Data

Most candidates managed to score four marks for this quality but 'real' marks higher than this were rare. Simple processing (eg averaging) and a description of the observed trend are all that is required for 4 marks and this was usually accomplished. Thankfully the use of an unqualified 'positive correlation' was not frequently seen (it is certainly not worth any credit).

Gaining higher marks proved difficult. A significant number of centres attempted to provide guidance to their candidates on what 'additional processing' to attempt but, in addition to being too much help, this rarely resulted in any additional marks as candidates didn't understand why they were doing the required task and so did not use the results. Simply spotting an anomaly will not do. Both the additional information and the detected anomalies must depend on the processing which has taken place. Simply spotting a point which is off the line or a measurement which is an outlier will not do as it can be seen from the raw data and/or the graph.

The most fertile area towards which candidates can be directed is showing whether their data is or is not valid. No guidance on how to approach this should be given. This is a high order skill which is designed to discriminate between the most able candidates.

Quality C: Evaluation of the Data

There are two strands to this skill and where candidates concentrated on only one aspect they were often marked overly generously. Since the assessment criteria are hierarchical the maximum mark is two where only one strand is addressed.

Candidates should discuss the methods used and how it relates to the reliability of the data. The reliability of the data is most easily accessed by considering the consistency of repeat values or, in the few tasks where there are no repeats, the proximity of points to the best fit line.

Candidates scoring 4 marks were not uncommon though 3 was sometimes more appropriate. To gain higher marks the validity of the data needs to be discussed. The concept rather than the word is important. Does the data from the experiment correctly represent what should have been obtained? The most straightforward way to approach this is to compare two data sets (another candidate's data is likely to provide a better comparison than the fall back data) or to use the graph to work out a quantity for which the value is known (this is only possible in some of the tasks).

Quality D: Justifying a conclusion

A significant number of candidates wrote a conclusion which, whilst it contained some science, was not directly related to the data obtained. Even for two marks it is necessary to relate the conclusion to the data.

The difficulty arises where the candidates have, understandably, been taught the necessary theory before the task is attempted. Weaker candidates then regurgitate this information with sometimes less than perfect recall and omit any mention of the data obtained in the experiment.

To score well in this quality the link to the data needs to be plain and the explanation needs to use appropriate and correct science which is clearly understood.

Having said that, most centres marked this quality with reasonable accuracy.

Quality E: Planning further work

Candidates in some centres clearly paid more attention to the criteria than to the question posed. These candidates (sometimes a whole centre) suggested further work which bore no relation to the problem posed in question 5. Such answers deserve no credit as the question has not been answered.

Some candidates gave a good answer to the second part of question 5 but, since their plan was insufficiently detailed, could score no more than three marks.

A detailed plan does not have to be pages long. It is intended that the investigation which they have just completed should be use as a basis. It is, therefore, not necessary to give great detail. 'The investigation just completed was repeated but…' is an acceptable way to start. After the 'but' should come;

- A description of the variables, which to control which to vary and which to measure.
- An account of how the variables are to be held constant and controlled.
- A range of values for the controlled variable.

This amount of detail would allow a third part to perform the intended investigation.

The most frequently omitted part of this description is the range of values to use. This omission limits the mark for quality E to three.

Internal Moderation

It is a requirement of the board that internal moderation of the work in a centre should take place. This is necessary unless all of the work is assessed by the same teacher.

Moderators have to judge whether the centre as a whole is marking to the same standard as other centres. A moderator is not permitted to change the rank order of the candidates in the centre. This means that if standards vary across different groups and if scaling of marks is required, unfairness to candidates can arise. Candidates who were marked generously will benefit as their marks will be reduced by a smaller margin than is appropriate, however candidates who were marked accurately will have their marks reduced to below what they deserve.

Where the problem is serious a centre will be asked to remark the work of all candidates and to resubmit their marks for moderation.

If MS1 sheets are sent which include the set of each candidate this can ease the problem. If only one teacher's marking is out of tolerance then the centre can be requested to remark the work of just that teacher. This reduces the workload of the centre and maintains fairness for the candidates.

Further guidance on assessment of skills can be found in the Additional Science Support Booklet which was sent to all centres and which is also available on Interchange and at www.gcse-science.com .

Next year a series of training courses will take place in different parts of the country details of these has been sent to centres and is also available on www.ocr.org.uk .

Centres can be part of a cluster. Cluster co-ordinators conduct meetings where centres can exchange ideas and experiences as well as receiving training.

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

OCR Customer Contact Centre

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

www.ocr.org.uk

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Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553