

Physics B J645

Gateway Science Suite

General Certificate of Secondary Education

Reports on the Units

June 2010

J645/R/10

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

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Chief Examiner's Report

Several examination sessions for these papers have been set now, and centres are clearly using past papers to prepare their candidates thoroughly. Some candidates also will be accessing the papers directly from the OCR website which is admirable. As a result generally the standard of answers continues to improve. Also the understanding needed to answer many questions has become more secure with more candidates. Whilst the contexts of questions do change, the science within them is clearly 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. And whilst this is still the case candidates seem to be getting more confident at applying knowledge in these ways.

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 'choose 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. Also occasionally the answer is left blank, probably as there is no answer line. At the end of question papers it is a good idea when candidates 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 increasingly well. This is partly due to the formula being present on the paper. However candidates do have to choose 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 (eg 15V rather than 1.5V).
- not using or forgetting to bring a calculator.
- dividing the numbers the wrong way (or is it the easy 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 [2 marks]. Many will incorrectly divide $6 / 3$ to get 2 [0 marks].

Centres should remind candidates that scripts are 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. Also 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 teachers 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 students.

B651/01 Foundation Tier

1 General Comments

Most candidates performed well and were appropriately entered at this tier with only a small number being able to achieve better at higher level. The paper was accessible to candidates with marks ranging from 54/60 to 12/60. The mean was above half marks at 39. On some scripts handwriting posed problems for examiners and, despite enlargement on screen, deciphering it offered challenges.

There was no evidence of candidates running short of time and most questions were completed by most candidates.

2 Comments on Individual Questions

- 1 This question was about interpreting a temperature graph showing ice and water. In part (a) most candidates could pick A as the section with the steepest gradient though some answered part C.

In part (b) many candidates correctly identified B as the section of the graph in which the ice was melting. For part (c) most correctly answered that temperature is measured in °C and energy is measured in J. The wrong answer of W (watts) was commonly given instead of J as the unit of energy. Most candidates scored 3 marks in total on this question.

- 2 This question on house insulation was well answered. Most candidates scored 5 or 6 marks in total.

In part (a) most selected 'walls' as the route of most heat loss.

In part (b) most gave 'double glazing' [1] for part (i). Most identified loft insulation [1] for part (ii) although it was not uncommon to see just 'insulation' [0] for this answer.

In part (c)(i) many referred to 'trapped heat' but many more wrote that 'air is an insulator' or even 'air is a good insulator'. Others got the mark for writing that air is a bad conductor. However a few candidates became mixed up and wrote that air is a good conductor, thereby failing to score. Most were able to calculate the correct payback time.

In the part of the question about placing foil behind a radiator most scored 2 marks for heat reflected back into the room. There were many fewer references to heat particles or air being reflected than have been seen in previous years and responses were better overall.

- 3 This question was about waves. Most candidates correctly identified the amplitude as option C. Candidates were less successful in identifying the wavelength, however, with A to E and D to E the most common incorrect answers.

In part (b)(i) ultraviolet was usually selected as the wave to give a suntan. A small number gave infrared instead. Part (b)(ii) was less well answered with radio and infra-red being the common errors.

Few candidates could convincingly define frequency in part (c)(i). However the calculation in the following part of the question was done very well with most gaining full marks.

Overall most candidates scored 4 or 5 marks in total on this question.

- 4 In this question on global warming many candidates referred mistakenly to the ozone layer. Most gained a mark for referring to cars as a source but many failed to score a mark for 'more CO₂', instead giving 'CO₂' which was insufficient. 'More greenhouse gases' was quite frequently seen and gained a mark. Very few wrote about deforestation as a cause of climate change. Many answers contained effects of global warming, such as melting icecaps, which were not credited. The majority of candidates scored one of the two marks available.

- 5 For part (a) good answers gave 'power' and 'switched on for the most time'. The majority of candidates could calculate the energy used as 3kWh but fewer went on to calculate the cost as 36p; most gave 24p. Some candidates were awarded this mark due to an error carried forward correctly from the calculated energy.

- 6 Part (a) was well answered with most writing 'heat and light'. In part (b) few latched onto wind power and turbines. Some gain a mark for referring to electricity being generated despite the process given being rather dubious. In part (c), the valid answer 'solar flairs' was infrequently seen but 'gamma rays', which did not score, was quite common.

Most candidates knew that satellites can be used for weather forecasts or spying. Some correctly referred to 'Sky TV' but those who wrote 'TV' alone did not score.

Most candidates scored 3 or 4 marks in total for this question.

- 7 Part (a) was well answered as most candidates knew that gamma has the greatest penetrating power. Very few made reference to ionisation in part (b) although there were some correct references to atoms becoming charged. In part (c) most gained the mark for giving rocks as a source of background radiation. Others referred to nuclear accidents at nuclear power plants. Some just referred to 'nuclear power', which scored zero, or 'power stations', which scored one.

This was a low scoring question with most candidates gaining zero or one mark.

- 8 For the electrical generation question most scored for a reference to moving the magnet near the coil. Some wanted to use a switch or add a battery however. The benefit of the doubt was given to those who wrote 'put the magnet near the coil' but 'put the magnet into the circuit' did not score.

Most knew that DC was produced by a battery. The commonest scores for this question were one and two.

- 9 On the completion of the diagram many scored full marks. It was rare for less than three to be gained and most knew of the Big Bang. This was a well answered question with many scoring full marks.

- 10 In this well answered question most candidates got three marks for distance, stopwatch and m/s (or another valid unit of speed such as mph). Credit was not given for mps.

- 11 In part (a), which concerned stopping distances, most candidates calculated 53m by adding the braking and thinking distances. Subtraction, multiplication and division were also seen however, as were arithmetical errors. In part (b)(i) many candidates grappled unsuccessfully with their wording. Marks were awarded to good answers that referred to the idea of the distance the car moves whilst the driver reacts.

Most candidates scored 2 or 3 marks in total for this question.

In part (b)(ii) many candidates gave alcohol, drugs or drinking as something that would increase thinking distance. Some wrote of poor concentration or described a distraction (eg 'using a mobile'). Some wrote about being more alert which was incorrect.

Few seemed to understand or even be aware of traction control. Examiners were seeking to award marks for answers that referred to more control when braking. This was rarely seen although 'shorter braking distance' was not uncommon and gained a mark. The answers 'quicker braking' and 'stops car skidding' were the most common routes to a mark.

- 12 Most candidates knew that diesel and petrol were the (fossil) fuels used in cars. Gas and oil were common but not valid answers. In part (b) most chose the motorbike as the more fuel efficient, although saloon car and van were popular incorrect answers. The calculation was less successfully done but most redeemed themselves by identifying the large number of people on the bus as a source of energy savings. In part (c) the idea of charging the battery was seen reasonably often. Most correct answers referred to a solar cell (or panel) charging the car. Many simply wrote that there is a battery but did not offer an explanation or a process.

Candidates scored well on this question with most gaining four or five marks.

- 13 The calculation of work done was well answered by most candidates. It is pleasing to see that almost all foundation candidates could select the correct formula, substitute the correct values and calculate successfully. In part (b) most referred to PE although 'lift energy' and 'stationary energy' were seen. Most knew that acceleration meant speeding up but fewer knew that KE would increase as it fell (many thought it was air resistance). Many knew that weight was the force although most expressed their answer by writing 'gravity'.

Reports on the Units taken in June 2010

This was a well answered question with four or five marks scored by most candidates.

B651/02 Higher Tier

The paper proved to be very accessible to the candidates. The level of performance was generally good with a higher mean mark than in the last two sessions. The candidates had been well prepared by the Centres and entered at the appropriate level. The best candidates scored in the mid to high fifties and marks below 20 were rare. There were no very weak areas throughout the three Modules although the following topics were poorly dealt with by candidates:

- phase
- advantages of digital signals
- principal focus for a concave mirror
- frequency of AC
- centripetal force
- K.E. and braking distance.

These areas were occasionally being tested for the first time or assessed in a slightly different context.

Mathematical ability shown by candidates was acceptable at the very least.

There did not appear to be any problem of time constraint.

1a

Candidates gave a variety of valid answers to describe a constant temperature eg flat line, horizontal line, no change in temperature. More able candidates also discussed intermolecular ideas although they did not need to do this. Weaker candidates often just stated 'straight or steady line' or related the graph to a speed (or velocity) / time graph and discussed constant speed.

1bi

The majority gained the mark; concrete was occasionally the given answer whilst oil was almost never given.

1bii

Weaker candidates struggled with the mathematical manipulation. More able candidates, having written a correct numerical substitution, often failed to compute the correct answer, sometimes producing an extreme numerical answer (e.g. 500 °C).

A small number used the s.h.c. for water or oil and successfully calculated the corresponding temperature rise to gain one mark.

2a

The best answers gave a good explanation of the process of convection and stated that conduction took place in the brick. Some correctly stated where conduction and / or convection took place then followed up with muddled descriptions of both mechanisms. Weaker candidates were confused between conduction and convection and often gave vague answers about hot air or heat particles passing through the bricks. Few candidates gave a good explanation of the process of conduction. Very few candidates referred to convection beyond the outer wall and radiation from the inner or the outer wall was never mentioned.

2b

Almost every candidate gained the mark for 4 (years).

2c

The vast majority of candidates gained the reflection mark whilst the mark for 'the idea of back into room' was usually gained. Some candidates referred to 'bouncing' and a few candidates referred to reflected (heat) particles. Weaker candidates referred to the room being heated or repeated the reduction in heat loss from the question.

The idea of heating needed less often was rarely given, despite being worth a mark.

3a(i)

Generally this mark was gained. Weaker candidates did not appreciate that frequency was a 'number' of cycles in a 'period' of time and only gave a partial answer e.g 'the number of waves' or 'how many every second'. Many did not gain the mark because they defined wavelength or period.

3a(ii)

Most candidates successfully calculated the correct answer.

3b

The majority chose longitudinal as expected, but surprisingly transverse, 'transvex' and primary were also given. Weaker candidates often put only one of the required parts in the second box whilst a small number quoted solid and liquid.

3c

Many candidates stated incorrectly that peaks **and** troughs occurred at the same time. The most popular correct answer was 'waves in sync'. Occasionally a clear diagram clinched the mark but diagrams were often poor and were clearly not lined up accurately and **out** of phase.

Approximately half of candidates correctly gave the idea of same frequency, often in the first part of their answer. This question differentiated well.

4a

Candidates often merely wrote about 'less interference' and so did not gain the mark. The ideas that 'a digital signal does not suffer from interference' or 'noise is very common' need to be addressed by Centres.

The idea of multiplexing or the ability to carry more information or data was more often given as a correct response. Better output quality (sound or vision) was often not scored as candidates did not make 'output' clear.

4b

Some candidates appeared to have been insufficiently prepared for this question and were confused as to how to construct their answer.

Amplify the signal or simply 'use a stronger signal' were frequently given incorrect answers. Greatest confusion occurred with incorrect references to diffraction; often candidates referred to diffraction occurring at the dish not the obstacle. The easiest marks scored were for bigger dishes and more dishes. Many candidates got the avoid obstacle and the higher positioning marks. Very few candidates mentioned the use of booster stations.

Overall the question differentiated very well.

5a

There was a high success rate with the kilowatt hours calculation; where the answer was wrong 1500W was usually given.

5b

In trying to be helpful, the question led weaker candidates to use the 'two' (hours) and give the wrong answer of 24p. Candidates often gave impractically high costs without any concern and for the e.c.f. in an answer to (a) of 3000, 36000p was seen occasionally and credited.

5c

Both marks were usually gained although weaker candidates calculated $230 \div 1900 = 0.12$ (A) or even 230×1900 .

6

Many candidates gained the reflected mark, although refracted or critical angle was seen too often. Very few stated 'focused' and even fewer answered 'converged' for the second part. Focal point was not often given and weaker candidates incorrectly gave 'point' or 'crossing point'.

7a

Very few candidates failed to secure this mark.

7b

Weaker candidates used biological expressions such as denature or mutate. Other popular incorrect answers were 'destroyed', 'damaged' and 'splits up'. Good candidates described the process in terms of loss or gain of electrons.

7c

'Rocks', 'living things' and 'cosmic rays' usually gained the marks whilst 'Sun', 'food', 'pollution' and unqualified 'nuclear power' were fairly common responses that failed to hit the marking points. Very few responses mentioned building materials; fewer still gave 'isotopes of carbon'.

8a

Most answers contained 'move magnet faster' and 'more coils' for both marks. Poorer answers were along the lines of 'position the magnet and coil closer' or referred to using a bigger coil or bigger magnet. Hardly any answers used the idea of inserting an iron core.

8bi

A surprising number of candidates believed that the frequency was the number of turns/rotations/peaks per second.

8bii

Most candidates gained the mark using a wide range of different expressions for 'one way'. Direct current was sometimes described as a current which 'moves in straight lines', 'straight' or moves 'directly' (amongst other incomplete descriptions). Answers in the form of a graph were extremely rare.

9

The majority of answers gained two marks with the first two correct, or the last three in the correct order, or one correct sequence with the start and end also correct. The most common errors were to interchange the first two or confuse very high temperature and thermonuclear fusion taking place. The candidates performed much better than with the continuous writing style previously used in the life cycle of star questions but there was still differentiation between the strongest and weakest candidates.

10a

There was a good level of differentiation in the question as a whole.

Reports on the Units taken in June 2010

Most candidates wrote 'gravity'. It seemed as if some candidates had not been taught the word centripetal or could not relate the term to the question. Some candidates wrote centrifugal and spelling mistakes were quite common.

10b

Answers that failed to gain this mark referred to gravity but did not clearly say that it **increased** as the comet moved closer to the Sun.

10c

Most candidates gained the mark but only wrote 'magnetic field' without entirely convincing the examiners that they understood what was actually taking place. Poorer answers just used the idea of being attracted to the poles or that there was a magnetic force.

Far too often responses claimed that it was due to 'gravity'; perhaps they were misled by the thrust of parts (a) and (b) and tried to continue the gravity theme.

11ai

The concept of fuel used appeared to be a relatively easy one but surprisingly few of the lower ability candidates gave the answer of 10. The regularly repeated incorrect answer was 250 litres.

11aii

The idea of more people usually secured the first mark. More able candidates went on to calculate that 12 cars were needed to match the figures for the bus. Answers referring to less fuel per person were very rare.

11b

Because the question did not tie the answers down to increasing or decreasing fuel economy most candidates were able to secure two marks with relatively ease.

There were many possible answers and many candidates gained both marks for using ideas about speed and weight. More able candidates went on to state or describe different driving conditions or driving styles. Very few referred in any way to drag or use of air conditioning or other electrical equipment in the car.

11ci

Unsuccessful answers referred to fossil fuels, repeated the question and only referred to pollution. Most candidates correctly referred to CO₂ or gases but emission of **less** exhaust gases, or more specifically less CO₂, failed to secure this mark.

11cii

Most responses were good and gained credit but poorer responses did not refer to **generation** of electricity, instead referring vaguely to energy. Vague answers about electricity being used to charge the battery or 'car' failed to hit the marking points. Answers in terms of battery disposal were rarely seen.

12a

This question was usually correctly answered, commonly with alcohol, drugs or tiredness. Examples of causes of lack of concentration were not as common but 'mobile phone' and 'radio' were the most frequent.

12b

Again, usually correct but there were too many wrong answers where candidates inverted the correct formula and calculated the answer of 1.33. Some rather long thinking times were produced using complicated and incorrect methods.

12c

Some answers were vague. The crash mark was most commonly gained followed by the mark for 24m thinking distance and the mark for calculating the 136m stopping distance. Poorer answers often just stated that there was 15m between the car and coach or quoted figures without using them to draw a correct conclusion. Weaker candidates merely mentioned breaking distance and did not make it clear that it was the **car** that would crash **into** the bus.

12d

This question differentiated the very best candidates from the rest. Only the most able referred to doubling the speed quadrupling the KE. The majority of candidates said speed increased so KE or breaking distance increased and so missed the point. Few gave the formula; those that did often quoted it but did not use it in an explanation. Very few gained the energy converted mark. Even more able candidates often referred only to energy being lost, reduced to zero or got rid of resulting in very few gaining all three marks.

13a

Candidates scored well here as the mark scheme gave many possible answers. Most referred to better grip or stop slipping. Better control was also a popular answer. Weaker candidates only discussed helping concentration or were confused with cruise control or the use of a paddle shift.

13b

Many referred to energy in their first response. Weaker candidates wrote force. For the second response, increase and decrease were given in almost equal proportions. In the last part increase and absorbed (acceleration) were the common incorrect answers. Overall there were good scores in the question with over three quarters of candidates gaining all three marks.

14

A good end to the paper: the two marks were usually gained. Candidates once again showed their ability to do straightforward calculations.

B652/01 Foundation Tier

1 General Comments

This was the sixth occasion that this examination was available to be sat by candidates. There were approximately 1150 candidates and marks ranged from 1 to 54 out of 60.

The mean mark for the paper was 35.0 and the paper discriminated satisfactorily over the target grade range of G to C.

There was no evidence to suggest that candidates had insufficient time to complete the paper but there were a significant number of candidates who failed to attempt parts of questions 7, 13 and 15.

Candidates should be encouraged to show how they work out the answer to numerical questions. In this way, credit can be given for showing how an answer is obtained, even if the answer is incorrect.

2 Comments on Individual Questions

Question No. 1 Three quarters of candidates knew how to charge a plastic rod and that there are two types of charge. A common misconception was that the cloth used to rub the rod had to be charged. The concept of earthing is not well understood. Most thought the reason for getting a shock is because the tap is a conductor or that charge jumped to the tap. More than a half of candidates suggested spray painting or other suitable use for static electricity but many failed to score because they simply wrote painting cars. Others suggested defibrillator, despite this being given as the example in the question stem.

Question No. 2 Just over half of the candidates knew that the earth lead is not required in a double insulated appliance; the majority of the remainder chose the live lead. A worrying quarter of candidates did not manage to match any of the colours to the correct terminal in a three pin plug. Fewer than half could match all three colours correctly. There were few candidates who could not calculate the value of the resistance.

Question No. 3 Only a third of candidates could suggest a use of ultrasound in hospitals other than scanning. Many had failed to read the question and suggested fetal scanning as their answer. Most appeared to know why ultrasound cannot be heard but many were not specific enough to gain credit. Answers such as too high were not worthy of credit. Few could explain a compression. Many stated that the waves were close together instead of the particles in a wave being close together. Those who illustrated their answer with a diagram were more likely to gain credit.

Question No. 4 This was not well answered. Many candidates appeared not to have read the question and wrote about uses of X-rays and gamma rays in hospital. A third of candidates suggested a smoke alarm as a use for alpha radiation. Many confused a smoke alarm with a fire alarm and therefore failed to score. The term nucleus was well known but few could describe a beta particle as a high-speed electron. Those who scored one mark usually described the speed rather than the particle.

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Question No. 5 The majority of candidates knew that uranium is the nuclear fuel used in a reactor but only a quarter could state that an uncontrolled reaction is used in a nuclear bomb. Only a small number of candidates knew how to make a substance radioactive by placing it in a reactor. The majority suggested placing it close to a source of ionising radiation.

Question No. 6 This question was well answered with many candidates scoring full marks.

Question No. 7 A surprisingly high proportion of candidates did not correctly identify the type of lens. Over a quarter did not attempt the ray diagram and nearly a half made no attempt at identifying the focal point. Part (b) had fewer correct responses than incorrect.

Question No. 8 This was generally well answered. Most identified the space shuttle landing as not being a satellite. The Moon was identified as the Earth's natural satellite (although the Sun was a popular alternative) and a good number of candidates could list two uses of artificial satellites.

Question No. 9 Interference is not well understood. There were few correct explanations and those who scored a mark usually did so for identifying sound as being a wave. The most common error was to state that Tracey heard sound from both speakers but Donna only from one. Whilst the majority know that light travels in straight lines, many thought air was an example of a vacuum.

Question No. 10 This calculation discriminated well. Only the more able candidates could perform a calculation where the starting speed was not zero. The difference between scalar and vector is not well known. A common misconception was to link a vector to distance instead of direction.

Question No. 11 The symbol for a bulb is almost universally known, whereas only two thirds of candidates knew the symbol for a capacitor.

Question No. 12 This question was well answered with the majority of candidate scoring both marks.

Question No. 13 This question was not well answered. More than a third of candidates made no attempt to identify the name of the potential divider circuit. Less than a third could state what a potential divider supplies to the rest of the circuit and even fewer could explain how the use of a variable resistor can alter the output voltage.

Question No. 14 A very small number of candidates recognised that a generator could be used as a motor. Dynamo was a common response. Most could name a household appliance containing a motor although television was a frequent answer. A surprisingly high number could not recall mains frequency with answers varying from 1 Hz up to several megahertz.

Question No. 15 Fewer than half of the candidates could calculate the number of turns on the secondary coil. Some calculated $4000 \div 220$ as 18.18 then multiplied by 11 to obtain an answer of 199.98. Imprecise use of English meant that many candidates failed to score a mark for explaining the difference in construction of a step up transformer.

Question No. 16 A third of candidates did not attempt the first part of the question and only one in twenty scored the mark. The nature of input and output at logic gates is not well understood and most candidates believe that the latch locks the car doors.

B652/02 Higher Tier

1 General Comments

Most candidates performed well and were appropriately entered at this tier; only a small number would have benefited from sitting the paper at foundation level. The paper was accessible to candidates with most marks in the range 60/60 (very few indeed achieved this) to 12/60. Some candidates scoring less than 12 made only partial attempts at the paper. The mean was above half marks and sits at a healthy score of 37. On some scripts handwriting posed problems for examiners and, despite enlargement on screen, deciphering offered some challenges.

There was no evidence of candidates running short of time and all questions were completed by most candidates. There were fewer 'no response' answers this year and some areas showed a stronger performance and understanding than 2009. Nuclear radiation, for instance, showed a great improvement.

2 Comments on Individual Questions

1 The first question on section A (module P4) was an Ohm's law calculation which was very well answered with almost all candidates gaining both marks.

2 In part (a)(i) most candidates could correctly name 'fission' as the process. There were very few wrong answers but fusion was commonly seen in this minority.

Many candidates wrote in part (a)(ii) that neutrons are absorbed.

In part (b) many knew that it was an electron and many went on to describe its high speed.

Part (c) discriminated well around the grade A boundary. Candidates at A or A* could generally successfully work out the mass and atomic numbers after beta decay. This was answered better than in previous examinations though some candidates worked out the product of alpha decay.

The most common scores for this question were five and six out of six.

3 This was the second question on nuclear radiation. In part (a) most candidates wrote about the idea of alpha having low penetrating power. Answers such as 'alpha can't get through the skin' and 'alpha can't be detected outside the body' were often seen.

In part (b) many answers merely referred to gamma and X rays being dangerous. Better answers used the idea that they are (highly) ionising. Other acceptable answers gave general wave properties, such as 'transverse'.

Most candidates gained both marks for this question.

4 The ultrasound question was answered well. In part (a) most candidates wrote about its high pitch or frequency.

Part (b) was more challenging. The idea of particles being closer together or more densely packed in a compression was not always secure in candidates' answers. Many referred to the 'waves being squashed' or the 'wavelength being shortened' and failed to score.

Most candidates scored one mark out of two for this question. Gaining the second mark often indicated a high performing candidate. The question discriminated well.

- 5 Many candidates found this demanding question on carbon dating a challenge. It discriminated well. About a fifth of candidates failed to score at all and the remaining candidates gave a good spread of marks.

In part (a) about half the candidates wrote carbon 14 or C14. Common wrong answers were C12 or uranium and even lead was seen. Clearly some candidates mixed up ideas about carbon dating with ideas about aging rocks using the uranium: lead ratio. Part (b) was an extended writing question worth three marks. Marks were available for the ideas of photosynthesis / gas exchange / respiration when alive (one mark) and also its absence when dead (one mark). Most candidates got one of these. A few wrote of the 'C14 getting less' but better answers mentioned 'C14 decay'. A few candidates attempted to express the idea of an equilibrium of C14 intake and loss during life. Some bypassed the idea of radioactivity (and the marking points) and were clearly writing about bacterial decay. Part (c) asked candidates to age a carbon sample given its half life and count rates. Many could work out it was two half lives which works out at 11 400 years. Some wrong answers attempted to halve the half life so calculating $5700 / 2$ was a common route to an error. A mark was available for those who demonstrated an appreciation of the count rate reducing from 20, then to 10 and then on to 5 counts per minute.

- 6 This question on static electricity was probably better answered than similar questions in previous series. Good answers described the electrons being rubbed off the cloth and onto the duster. Some wrote of electron movement but had it moving the wrong way (from duster to rod, this still scored one mark). 'Positive electrons' were again a common misapprehension used to construct unconvincing answers. Some also mistakenly thought that it was the positive charges that moved.

Overall 6 out of 10 candidates scored full marks on this question.

- 7 The first question on section B (module P5) was about projectiles. Almost all candidates knew that 'weight' or, more commonly, 'gravity' was the name of the downward force acting on the projectile.

In part (b) most knew that the horizontal component was unchanged and that the vertical component would increase.

In part (c) most drew the correct vectors at 90° and could then draw their resultants using Pythagoras' theorem and calculate their magnitudes.

Over half of candidates scored four or five marks on this five mark question.

- 8 In part (a) candidates were asked to complete the ray diagram. Marks were available for all rays drawn (at least two were required) converging to a point on the principal axis. This was generally answered well.

Part (b) asked candidates to write down the differences between the lens used in a projector and that used for a magnifying glass. Examiners were seeking to award marks for the ideas that the projector lens produces a real inverted image. On the

other hand the magnifying glass has a virtual upright image. Some answers were excellent, satisfying more than two of the marking points. Others failed to identify which lens was being described. So, for example, 'one lens has a real image and the other one is virtual' scored zero.

In describing what happens to the position of the lens during focussing many referred to moving the lens closer or further away from the screen / object for one mark. 'Forwards and backwards' was a common acceptable answer but merely 'closer' fell short of the mark.

- 9 This question on diffraction was quite well answered with 6 out of 10 gaining full marks. Most gave radio as an answer but fewer gave diffraction as the second answer. Sound and refraction were common incorrect answers.
- 10 The cat's eye context for this critical angle question offered a deliberately challenging question for all candidates. Some able candidates wrote of the incident angle being greater than the critical angle (42°) and gained the mark. Better answers also referred to the different densities or refractive indices.

Part (b) was a challenging calculation question which discriminated well between the most able candidates. Half the candidates failed to score at all on this (despite most attempting it). Only a third completed a correct calculation but a further sixth made some purposeful headway in their working and thereby gained credit.

On question 10 overall, 4 out of 10 candidates failed to score. The remainder gained a spread of marks with less than 1 out of 10 gaining full marks.

- 11 This question about speed, velocity and distance was set in the context of a cycle race. In the first part many were successful on the calculation. For those who selected and substituted the correct values into the correct formula most went on to successfully calculate 48 as the answer. As with most calculations, if the final answer was wrong then credit was given for correct working.

In part (b) candidates were asked to explain the difference between vector and scalar. Most described vector as having direction as well as magnitude or size. Some attempted this but did not quite convince examiners: e.g. 'vector is distance'. Others who failed to generalise used examples to good effect: e.g. 'velocity is speed in a certain direction'.

Just less than half the candidates scored full marks on the whole question.

- 12 This question on resistance was well answered. Most got the ideas of reduced resistance allowing a larger current to pass. Some described the effect as 'stronger current' or 'faster current' and did not score.

Part (b) was correctly answered by most.

- 13 This question on the potential divider discriminated well at the top of the ability range. In part (a) many answers referred to using a variable resistor 'in the circuit'. Better answers were mainly about replacing R1 or R2 with a variable resistor. It was good to see a few candidates suggested LDRs or thermistors instead.

The calculation was answered correctly by over three quarters of candidates. This shows much better understanding than in previous years.

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- 14 Many candidates knew that the field around the wire was circular. Some failed to fill the answer line but drew circles on the diagram which was sufficient to earn the mark. Some described it as 'oval' or even 'spherical' which did not score while others described the shape of the card.

Part (b) was answered correctly by many.

Over half the candidates gained full marks on the whole question.

- 15 This question on transformers offered a calculation which was done quite well by more able candidates. Many However many, having got the ratios correct, failed to reach the final correct answer.

In part (b) the idea of more turns on the secondary coil was covered by over half of candidates' answers. Over half the candidates gained full marks on the whole question.

- 16 In part (a) a relatively simple recall question proved too difficult for many. 'Diode' was the correct answer but common answers were 'rod' or 'chip'. Less than half the candidates scored the mark.

In part (b) marks were available for a low resistance in the positive direction and a high resistance in the negative direction. Some candidates gave excellent higher level answers in terms of holes. Others explained the threshold voltage convincingly. These types of answer were rewarded accordingly.

- 17 This question was about an electric motor. It was pleasing to see rather fewer candidates this year confusing motors with generators in their answers. In part (a) the idea of allowing the motor to continue spinning or turning gained credit for many. In the more demanding part (b) the purpose of a radial field was a mystery to many. A few good answers correctly referred to the 90° field.

- 18 The answers to this question about the use of electronic gates hinted that many candidates had not prepared themselves sufficiently for this area. In part (a) many could use the table to construct a reasonable answer however. Others offered explanations in terms of a NOR gate being (being like) an OR gate with a NOT gate. In part (b) generally only the most able were able to correctly suggest the appropriate wiring for the bistable latch circuit. One mark was available for each of the two correct connections. About 4 out of 10 gained full marks on the whole question.

B655 Physics

General Comments

By now, this system of Skills Assessment involving Can-Do tasks and Science in the News has had time to become established. Although many centres can now do this well, there are still some centres that are having problems. The problems are the ones reported previously in these reports in 2008 and 2009. Centres should use the information in these reports, the support of training events and advice available from OCR.

It is pleasing to report that, as last year, there are many candidates who now produce good considerations of the topic, looking for and against and then using their research to come to a considered decision. Unfortunately there are still many who seem to regard this aspect of the specification as irrelevant and go through the motions. This often involves giving Science in the News tasks without preparing the students with the necessary skills.

A total of 10202 candidates, from 270 centres, entered candidates for Physics (B655).

It is possible that candidates use the same piece of SinN 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. Some centres continue to ignore this important point. Failure to do this makes the Moderator's job more difficult and could lead to unnecessary errors.

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. 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 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. It is noticeable that in many centres all, or a vast majority of candidates, score 24/24 for Can Do tasks. It is not uncommon for candidates to score 24 and produce nothing for SinN. Despite the column on the form, dates are not essential.

In a separate science (eg Physics) all the Can Do tasks must be from the separate science (eg Physics) list.

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 have been added each year. It is disappointing that the vast majority of centres choose tasks from the original list eg whaling; cannabis etc when new tasks have been added to Interchange each year.

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The tasks available for 2010 are shown below. New tasks have been added for June 2011. No further tasks will be added.

Module	Title
P1	Should we spend time in the sun?
P1	Is human activity responsible for increased global warming?
P2	Does the UK need new Nuclear Power stations?
P2	Are asteroids a threat to us?
P2	Does the UK need more wind farms?
P5	How safe are mobile phones?
P5	Will fitting a child safety seat save lives?
P6	Do high voltage power lines pose a risk to health?

Some centres still use unapproved and unsuitable tasks, especially if they used them for Entry Level. If they don't match fully the requirements of a task candidate marks will suffer. One centre produced its own Science in the News task which was submitted and approved for use in the centre. However, in the end it did not figure in the moderation sample.

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.

All SinN are written under controlled conditions where the teacher can sign the Centre Authentication Form (CSS160) with confidence.

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.

OCR provides a writing frame which should only be used with lower-attaining candidates. 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 for all tasks. There are still a few centres trying to use non-generic writing frames or giving too much direction to candidates.

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 them which are for and which are against the argument is going too far.

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

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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, it was felt that in some centres the candidates had been 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. The best reports came where candidates had the freedom to investigate the question set.

Where there are a large number of candidates in the sample it is reasonable to expect

- Different source materials to be used,
- Different processing to be done and, for example, not all candidates having the same bar chart display,
- Candidates answering the question in different ways.

It was not unusual for a centre with over 100 candidates to use the same topic with all candidates and, to make it worse, it to be the same topic as in previous years. Candidates in that centre may finish the course believing there is only one scientific question worth discussing. In the best organised centres a range of tasks were used. Some centres use the same task because they have developed a marking scheme for it which will ensure internal standardisation. Mark schemes are not advised and reports should be marked using the criteria and not a mark scheme.

Administration matters – supervised session

When the preliminary research has been completed, the SinN 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.

Candidates can bring into the session completed charts/graphs that they have done together with a completed bibliography. This will prevent time being wasted during the session.

Some candidates are using word processors to produce their reports.

Centres are reminded 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 completed 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.

It was an increasing trend, this year, to see word processed reports where almost the whole report had been pasted in electronically from websites without any acknowledgement as if it was the writing of the candidate. Awarding Quality F marks when this is done is very difficult because it is not the work of the candidate.

Under no circumstances should any Science in the News tasks be drafted and subsequently redrafted. What is produced at the end of the supervised writing session is what has to be

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submitted. If there are deficiencies, this should be reported to students and they should be told to avoid these when they do their **next** SinN. There was still clear evidence that drafting and redrafting went on in a very small minority of Centres or teachers advising candidates to make additions. This is totally **unacceptable**.

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

Can-Do tasks

Can-Do tasks are an important part of the Gateway Science specification. They are motivational for students at all attainment levels. The tasks ensure that practical Science is an important aspect of the specification, and they can also ensure that ICT is used appropriately. They are not expected to differentiate well for candidates at Grade C and above. 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 well at Grade C and above, it is essential that the necessary differentiation between the levels of attainment of candidates is obtained using Science in the News.

The mark descriptors 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. For example the word 'anomaly' appearing anywhere can, in the view of some teachers automatically lead to the award of 6 marks in Quality B.

It has always been OCR policy to encourage teachers to annotate Coursework. As candidates may attempt several SinN this represents a burden on teachers when, in reality, very little of the work will be seen by a moderator. In fact, in line with the sample size in other GCSE subjects with OCR, sample sizes for larger centres were significantly reduced. It is recommended that the emphasis should be given to reporting back to students so they can improve in the future. When the sample is requested by the moderator, a little time should be spent annotating the 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 use to support 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. Several centres had clearly not internally standardised the marks and consequently the rank order was not valid. In such cases the sample or parts of it had to be returned to the centre for remarking. Where this was done the remarking was done graciously and centres realised moderators were trying to do their best for the candidates.

It does happen that all the marks of a centre are reduced by one or two teachers over-marking and internal standardisation not recognising this.

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. However, candidates who do not do any research for themselves 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 fully reference and **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.

Without detailed referencing it is very difficult 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 at both sides of the issue. Centres are reminded that 6 marks are 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. Centres awarded 6 marks routinely even when there was insufficient balance in the report. 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 eg '*...more women get skin cancer than men...*'. It is not sufficient to quote just a fact eg '*...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 centres who cannot distinguish a trend or pattern from a fact. There are many examples of candidates carrying out processing, even quite advanced processing, without identifying any trend. This is still not even 2 marks as the mark descriptors are hierarchical.

For 4 marks there must be evidence for at least two trends, although which is the main trend may not be obvious, and some processing 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 be given credit. Teachers are reminded that, for the sort of data obtained, bar charts are often more appropriate than line graphs.

Few candidates progressed 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. This is an increasing and unwanted trend where teachers are pushing candidates to do things they don't understand. This was reported on last year but it still persists.

The moderator does expect to see different approaches to the same Task from different candidates within the Centre. Some examples were identified where several candidates completed the same incorrect processing and where the centre gave some candidates credit and others not. This sort of thing should be picked up in internal standardisation.

Quality C (Evaluation of the data)

The accuracy, reliability and validity of data are important aspects of Science National Criteria and they are assessed in Science through SinN. There are still some reports, but fewer than in previous years, where these are 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. 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)

Again social, economic and environmental aspects of the topic are an important part of Science National Criteria and which some centres did not develop sufficiently with their candidates during the teaching process.

Often these social, economic and environmental aspects were diffused throughout reports rather than in a separate section. It is clear that the candidates rather than planning to include them as an important aspect of the report, have stumbled across them accidentally.

Different SinN 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.

Quality E (Justifying a conclusion)

All of the tasks are posed as questions and therefore need an answer. Almost all candidates gave an answer to the question but often the answer was not derived from the work they had done but from some preconceived ideas. For example, of course whaling should be banned because it is cruel.

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

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a candidate needs to decide which source is more significant. Few candidates are doing this. It is here that researching sources with different viewpoints becomes helpful.

Quality F (Quality of written communication)

Most Centres were quite good assessing this Quality. However, 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 use of scientific vocabulary correctly used.

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

Probably, the most common error was to award 6 marks for a report with little scientific vocabulary. High marks cannot be given when work is just pasted in or copied from a source. Some reports had been word-processed and a spell-checker obviously used. There is nothing wrong with this providing the spell-checker is used correctly.

Summary Comments

The moderator tries to support the marks awarded by the centre. Providing the average marking is within plus or minus 4 marks no change is made as the centre is deemed to be 'within tolerance'. Where the marks are outside tolerance and adjustments have to be made, the work is considered by at least two moderators. Where a centre is outside tolerance the marks of all candidates are changed even if, perhaps only a few candidates are outside tolerance.

Moderators were encouraged to provide useful reports for Centres. Too often centres do not take sufficient notice of these reports. If the report suggests the marking is generous but within tolerance, it is important the centre addresses this because next year it might be just outside tolerance.

The moderation was accomplished efficiently and effectively, with experienced moderators. Much of the success was due to the work of Team leaders in co-ordinating their teams.

The importance of cluster group meetings, attendance at OCR INSET meetings and meetings arranged in-house all provided centres with an appropriate awareness and understanding of the new framework. Centres should have copies of the Science Support booklet (which is also available on Interchange).

Many Centres have used the free OCR Coursework Consultancy service. Each year a Centre can submit good quality photocopies of three marked SinN reports to OCR. They will then receive a written report from a senior moderator on the quality of the marking. This means centres can then enter candidates for moderation with some confidence.

B656 Physics

General Comments

This was the third year for the skills assessment in this specification and, as expected, the majority of centres produced well organised samples of work which did not require scaling.

On behalf of all this year's moderators I would like to thank those centres.

It is the job of a moderator, where possible to support the decisions made by centres. Centres which complete the paperwork correctly and which add helpful annotations to the candidates' work make that task much more straightforward.

Administration

Some centres made administrative errors which delayed the moderation process.

Some of the errors encountered were:

- Failing to include a Centre Authentication Form for each specification entered. This can result in marks being withheld.
- Failing to attach the 'Skills Assessment Record' to the front of the candidates work. This means that the moderator cannot be sure of the candidate's practical skills mark.
- Wrongly transferring marks from the record card to the MS1 sheet.
- Wrongly adding together the three marks on the record card.
- Failing to include a copy of the MS1, this problem usually arose with centres with small numbers of candidates who sent in all the work completed.
- Using tasks from modules 5 or 6 for 'Additional Science'.
- Entering candidates for the wrong skills unit in separate sciences.

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 filling 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 be beyond what could have occurred by coincidence.

Where this occurs and plagiarism has clearly taken place, neither candidate's work should be credited.

If candidates are supervised properly, according to the board's regulations, this should not occur. Please note:

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- 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

The comments listed by quality below are aimed chiefly at centres which were wayward in the use of the marking criteria. There are, however, hints as to how candidates may gain higher marks in each quality.

Research Studies

These are RESEARCH studies. It is not intended that the content should be taught. Work done 'in class' does not count as research and candidates who approach the task in this way rarely score the highest marks.

Most centres correctly instructed candidates to answer the five questions as the best way to complete a Research Study. An essay type answer does receive credit but it is much harder for candidates to ensure that they answer all the questions fully.

There were a couple of instances of candidates taking the title of the study and then writing their own version of it. This often resulted in poor marks as the questions were not answered.

Quality A: Collecting Information

Two marks can be awarded if sufficient research has been done to allow the questions to be answered, even if no references are given.

For marks of four and above full URLs or the equivalent must be given. It is not sufficient for a teacher to endorse the work saying that the research has been seen, the references must be physically present in the written work.

Higher marks involve the references being linked to the information they have provided. If they are merely linked to questions 5 marks is appropriate. For six, the references must be linked to the information within the answer.

Quality B: Interpreting Information

It should be noted that this quality involves the interpretation of information not merely of data. Answers, in some studies, which involve the drawing of graphs may provide evidence of this skill at a low level but to score higher marks candidates must demonstrate that they understand the science which they use in the study.

Work copied directly from sources can receive credit if it is directly relevant to the question posed. However, to score the highest marks, candidates must have ownership of the information

to show that they fully understand it. Their own words are best but at least a comment or analysis of the information copied from the sources must be present.

Quality C: Developing and using Scientific Ideas

The criteria for six marks asks candidates to “demonstrate a clear and detailed understanding of the interaction between scientific ideas and their context”.

The context is sometimes a topical issue in science and sometimes an extension of the science in the specification into an area which it does not cover.

Marks can be awarded by considering how well the candidate has linked the science they have researched to the ‘context’ and how well understood it is.

The same caution should be used about teaching the context. If a candidate does no research it is difficult for them to show their understanding of it.

As above, text copied from a source can only be given limited credit.

Quality D: Quality of Written Communication

This was usually marked accurately. The one exception being centres which gave credit for the written English copied from the internet (or other source). It is the candidate’s own English which is relevant. The extensive and correct use of technical and scientific vocabulary is more important than absolute grammatical accuracy.

Data Tasks

It is expected that most centres will actually carry out the Data Tasks. The ‘fall back’ data are provided for use if a candidate is absent when the practical part of the task is carried out or for use if a candidate’s own data is not of sufficient quality to enable the questions to be attempted.

It was worrying to see so many centres not even attempting the practical work. This practice disadvantages candidate in answering the questions linked to qualities B and E in particular.

It is recommended that if a candidate has poor data that they use the ‘fall back data’ to answer questions 1, 2 and 4 but their own data to answer question 3.

It is important that candidates include their results with their Data Task even if they have used the fall back data. The simple processing (usually averaging) has to be checked as has the accuracy of the plotting in the graph. If the raw data are missing then the maximum mark available for both question 1 and question 2 is three.

Quality A: Interpreting the Data

Graphs were usually well plotted and drawn. Marks lower than four were rare. For the highest marks the graph should be large (at least half an A4 sheet) the axes should be labelled with quantity and unit and be linear.

Plotting should be perfect (or almost) and the points should be joined by a ‘best fit’ line or curve as appropriate.

An inappropriate line was the most common reason for marks being reduced.

Not all graphs go through the origin.

Quality B: Analysis of the Data

Simple processing and a description of the trend observed were usually accomplished.

References to 'positive correlation' should be discouraged and if there is no statement as to what the correlation is between, the candidates should receive no credit.

A mark for describing the trend can be awarded if it appears in answer to question 4 even if it does not appear in the answer to question 2.

A genuine mark above four was rare.

To gain higher marks additional/further processing must be undertaken. It is not sufficient merely to find a gradient or do some other thing with the data. The processing must reveal something which was not evident before the processing had taken place.

The most common way of achieving this aim was to show that the data was not valid by showing that it did not do what it was supposed to do.

The revealing of an anomalous result would also count. However, it is not sufficient to spot a result which is not on the 'best fit' line. It must be an anomaly which was revealed by the additional processing.

Centres which told candidates what additional processing to do were giving too much help to their candidates. However, it rarely did any good as the candidates did not realise why they were doing it and so received little credit.

Quality C: Evaluation of the Data

Reliability and validity are the key words. Reliability usually has to do with the comparability of repeats but can be addressed through proximity to a 'best fit' line.

It was disturbing to find so many candidates who thought that repeating made data more reliable. It MAY make the average more reliable if the errors are random but not the raw data.

Validity is best addressed by comparing two data sets or by using the data to calculate a known value and comparing the two.

Quality D: Justifying a Conclusion

This was often well answered and was usually accurately marked. In some centres, however, little if any reference was made to the data obtained. Candidates merely regurgitated an explanation which had been taught before the investigation was undertaken. Such answers were rarely worth many marks.

It is essential that the explanation relates to the candidates data and fully explains it.

For the higher marks it is also important that candidates fully understands the science being used.

Quality E: Planning further Work

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It is intended that the investigation to be planned will be an extension of the work already done. The same apparatus can usually be used with only the variables and the means of controlling them being different.

A 'detailed' method must include:

- Variables; which are held constant, which varied and which measured.
- Control; how, practically, the variables are to be controlled and varied.
- Range; what range of values are to be used for the controlled variable.

V C R could be a useful mnemonic.

Practical Skills

It was pleasing to see, in some centres, a use of marks other than 6 for practical skills. It was surprising to see, on a number of occasions, centres awarding 6 marks throughout for practical skills but where all candidates used the 'fall back' data in the Data Task.

Separate Sciences

It was pleasing to note that more of tasks specifically linked to modules 5 and 6 were used this year. Indeed some proved so attractive that they were even (mistakenly) used for Additional Science.

This is, of course, not allowed.

The problems encountered by centres and their candidates were similar to those detailed above though, because of the different spread of abilities in the candidature the marks tended to be higher.

Internal Moderation

Internal moderation by centres is essential and is required by the board. Only in the case of a single teacher marking all of the work is it rendered unnecessary.

The moderator is required to judge whether a centre is marking according to the same standards as others. A moderator cannot change the rank order of the candidates in the centre. This means that, if one group has been marked very leniently and scaling needs to be applied, candidates who have been marked accurately also have their marks reduced. This is not fair to the candidates or the centre.

If such inconsistency is detected in a centre's marking it can result in a request for the whole of a centres work to be remarked.

Other Matters

Where it is necessary to adjust the marks of a centre the work is looked at by at least two moderators.

If the adjustment is large it is looked at by at least three including the Principal Moderator.

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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 have 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.

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