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GCSE

Physics B J645

Gateway Science Suite

General Certificate of Secondary Education

Report on the Units

June 2008

J645/MS/R/08

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B651/01 Foundation Tier

General Comments

As expected there was a relatively small entry for this paper of about 600 candidates. All candidates seemed to be entered for the correct tier. Marks ranged from 8 to 53 with 95% of candidates scoring above 20. The paper performed well with all marks being accessible. The general standard seemed to be slightly better than in the January examination.

As in previous papers candidates should be advised to read the questions carefully. Several candidates penalised themselves by only giving one answer where two were required and vice versa.

The number of lines provided indicate the length of answer expected. Several candidates wrote answers that went beyond these lines which were difficult to mark as the answer fell outside the marking frame.

Comments on Individual Questions

Section A (Module P1)

Question 1

Most candidates answered part **(a)** correctly however a small number answered the question which foods have to be cooled down instead of the one set.

In part **(b)** the majority of candidates scored however several candidates said that black attracts light. This failed to score as Examiners were looking for the words absorb, and heat, radiation or sunlight.

Question 2

Most candidates were able to give correct answers to part **(a)(i)** although some just repeated the question and stated to detect body heat. The most common correct answers were as burglar detectors or to switch security lights on. The most common answers to part **(a)(ii)** were remote controls or for cooking. Some candidates gave two uses of the PIR sensors which did not score in the second part.

In part **(b)** the majority of candidates identified digital as the first missing word but chose refraction as the second.

Part **(c)** proved difficult for candidates with only about 10% scoring on this question. Examiners were looking for the idea that it was a narrow beam, intense, one colour (or red or infra red) they also accepted higher level answers such as in phase or coherent or diagrams showing this.

Question 3

The vast majority of candidates identified seismometer as the correct answer in part **(a)** and about half were able to answer part **(b)** correctly. B was a common error in **(iii)**.

Question 4

The calculations were answered well in part **(a)** with most candidates scoring well. Some candidates calculated the missing figures correctly in the table but then copied the wrong answers into the questions. The most common mistake was to multiply 200 by 2 in part **(iii)**.

In part **(b)** very few candidates were able to state that air being a poor conductor was the reason for its importance in loft insulation.

About three quarters of the candidates knew that the foil reflected heat back into the room in part **(c)**.

Section B (Module P2)

Question 5

Surprisingly few candidates gave a correct answer to **(a)(i)**. Examiners were looking for ideas that the energy source was renewable or free but did not credit those candidates who wrote just free or renewable. Similarly vague answers such as environmentally friendly did not score. More candidates were able to find a disadvantage in part **(ii)**, the most common being that they do not work at night.

The majority of candidates stated that the sun's energy could be used for heating in solar panels for part **(b)**.

Part **(c)** performed badly for such a straight forward question with less than 10% giving the correct answer of DC.

Question 6

About 30% of candidates knew that the over-ground power lines are called the National Grid or the job of the transformer. Several candidates erroneously thought that transformers changed the power in a circuit.

In part **(b)** candidates were asked to name a fuel used in power stations. The answer fossil fuel was therefore not accepted.

Most candidates were able to calculate the power of the iron in part **(c)**.

Question 7

Most candidates correctly linked the radiation with its penetrating power.

In part **(b)** a large number of candidates thought that nuclear radiation was used to generate power. The simplest expected answers for parts **(i)** and **(ii)** were treat cancer, and cause cancer respectively.

Question 8

Almost all candidates were able to identify things needed to keep astronauts alive in part **(a)**.

And most went on to correctly identify a use for artificial satellites in **(b)**.

In part **(c)** few candidates knew about the theory of how the moon was made. 13% of candidates did not attempt this question.

In part **(d)** candidates knew that asteroids were made from rock – those that got it wrong usually added ice or gas to a rock answer. There were about 50% correct answers to part **(ii)** the remainder tended to let their imagination run away with them and described the 'total destruction of the earth' and the earth being 'knocked off its axis'.

Section C (Module P3)

Question 9

Whilst part **(a)** is straight-forward only about 50% of candidates correctly answered it. The majority of those getting it wrong added stopwatch to the answer.

Most candidates answered the whole of part **(b)** correctly.

Question 10

In part **(a)** most candidates knew that accelerating meant changing speed.

And in part **(b)** the majority correctly calculated the acceleration as 3.3.

In 10**(c)** candidates found it difficult to explain and often said that B had a higher final speed or that B travelled a greater distance. In order to score candidates needed to say that the change in speed of B in 3 seconds was greater or calculate the two accelerations as was done by the more able candidates.

Part **(d)** produced its usual wrong answer of "stopping distance is the time ….." which always scores zero. Examiners were looking for the simple statement thinking distance + braking distance. Most candidates in **(c)(ii)** gave correct answers but there were too many vague answers such as road conditions or brake/tyre condition. These answers failed to score as the question had clearly asked about increase of thinking and braking distance.

Question 11

This was the first time question had been asked in this way and the majority of candidates scored 3/4. The spelling was generally ignored as long as the words were recognizable. 2 across could be either height or weight. Some candidates just filled in words that went outside the grid or chose random letters.

Question 12

In part **(a)**, about half the candidates were able to state that distance or movement was needed for work to be done. Most candidates were able to give an example of where work was done, and the majority of candidate identified the joule as the unit of work and energy.

Question 13

The majority of candidates correctly identified crumple zone as the answer to part **(a)**.

In part **(b)** only a few knew that they worked by absorbing energy. The majority wrote that they absorbed the force or absorbed the impact which was not credited.

B651/02 Higher Tier

General Comments

This was only the third separate Physics examination in the Gateway syllabus where candidates were being assessed in units P1, P2 and P3. The paper contained a number of questions that tested areas of the specification in these three units that had not previously been assessed. Bearing this in mind the performance of the candidates was very encouraging, many candidates scored high marks and a significant number displayed outstanding levels of knowledge and understanding. Furthermore, very few low marks were recorded and Centres had clearly made the correct entry decision for the vast majority of candidates.

Centres had obviously prepared their candidates very well and the Item coverage across the three modules being tested was very thorough.

Some questions did cause many candidates problems, notably questions 3, 6, 7(b), 12(b) and 14 (although there was a spread of target grades {CBA} in the question).

The reasons were in all probability varied;

- new area being tested
- a different question style
- poor mathematical ability

In these questions candidate's answers were often in the right area but failed to tailor their knowledge to the question that was being asked.

There was also some confusion between ionisation and ionic bonding in question 8(b). Usually, better quality answers were succinct and homed in on the salient points quickly whereas poorer responses often rambled with very few relevant scientific points being covered.

There was no evidence that time was a problem for the candidates, very few 'no response' answers were in evidence and no unfinished scripts were seen.

Similarly, there were no general misinterpretations of the rubric although in some questions candidates often thought more information was required in an answer than was actually needed and they wrote well beyond the number of answer lines often not gaining any further credit.

Some candidates let themselves down by not paying sufficient attention to the stem of the questions, so their answers were not sufficiently focused to gain full marks.

Comments on Individual Questions

Section A (Module P1)

Question 1

(a) The vast majority of candidates (above 90% in each part) were off to a good start and gained the maximum number of marks in the first part of the question. In part **(iii)** 2 x £200 = £400 was the error most seen for a wrong answer.

(b)(i) About a quarter of the candidates could not do the substitution or do the arithmetic to calculate the temperature rise. The majority were able to calculate 50^{o}C but only the better

candidates (approximately one third) were then able to correctly calculate the final temperature. This was a good question for providing differentiation.
(ii) Likewise, this question gave good differentiation. Good answers went straight to the point with answers of heat transferred to the room and one mechanism of how (radiation or convection). Poor answers were constructed around 'efficiency', 'impurities in / boiling point of the water' or 'evaporation of water'. Some made references to the temperature setting on the heater or made incorrect use of the information about SHC.
(iii) Overall a sound level of application of SHC with some good descriptive answers. Poor answers included ideas about conduction, boiling point, viscosity or failed to mention per degree or per kilogram. Just over half of the answers gained the mark.

Question 2

(a) Water was the correct answer from the majority with fat or starch sometimes given as the answer but by far the commonest error was to write 'skin'.

(b) A success rate approaching 70% in this question although a significant minority of candidates merely wrote about heat being retained or reflected.

(c) The concept of particles vibrating and possessing kinetic energy once again stumped a lot of candidates but answers were better than previous years with less than 1/3rd failing to score and almost half gaining both marks. This was encouraging for an A/B question.
Heat particles, the foil reflecting heat back and ideas of the heat passing or being conducted to the centre with no mention of particles of the potato blighted many answers. However, there were many excellent answers that gained both marks with sound descriptions of how particles passed KE to other particles in the potato.

Question 3

(a) Candidates often found difficulty in expressing the idea of TIR briefly and failed to state 'TIR' takes place or adequately describe multiple reflections. There were numerous answers that struck straight home with 'total internal reflection' often accompanied by a suitable description or acceptable diagram.
Good answers often reflected statements in the specification (multiplexing, less interference or signal loss). Candidates often answered in absolute terms (eg stops energy loss / no information loss) and failed to gain the mark. Over 60% of the entry did not gain this more difficult mark.

Question 4

Despite this question relying heavily on objective tasks it differentiated well between the candidates just above and below C-grade.

(a)(i) & (ii) Two marks were gained by the vast majority but the correct responses were sometimes reversed.
(iii) Again most candidates (approaching three-quarters) were successful but wrong choices were evenly divided between the two incorrect options.
Straight recall was no problem for a lot of candidates but many just wrote 'primary' and 'secondary' on the answer lines. This part differentiated strongly as the success rate was only slightly above half of the responses.
A number of candidates put longitudinal and transverse in the wrong order.

Section B (Module P2)

Question 5

(a)(i) There were a surprising number of responses that merely stated 'renewable' without reference to the energy source or wrote no pollution without qualification. Over half of the responses were correct and this offset the disappointing ones.
(ii) The mark was awarded in the vast majority of cases (80%). The most frequently allowable responses were along the lines of 'no power at night' / 'will not work in bad or dull weather / when the sun is not shining'.

(b) This was a searching question but candidates responded to it. The best candidates produced impressive accounts often above that expected and comfortably covering all of the marking points. However it did differentiate; weak answers did not score or gained one mark and better efforts were rewarded with two. Poor answers were on the wrong track, thinking that the question was about a solar heating panel, or the electrons gained heat energy and these responses rarely gained any credit beyond one mark.
This question differentiated very well with less than one-third scoring all three and the proportions gaining zero, one or two being evenly divided.

Question 6

(a) The question was set in a different way to ones testing the same syllabus area in previous papers.
This obviously threw candidates as they tried to fit well tutored responses into a new context. Two marks were rarely attained with over half of the candidates failing to gain any mark. Very few candidates recognised the significance of the magnet moving and it's changing direction, concentrating instead on the changing direction of the current.

(b) This part followed in a similar way as the first part as candidates struggled to get to grips with relating the AC pattern to the experimental set up although there was however a higher success rate than in the previous part.

Question 7

(a) The calculation was successfully completed by a huge majority of the candidates, very few failed to secure maximum marks.

(b) Unlike the first part this was not well done, which at the higher tier was something of a surprise. Over half failed to register any mark whilst the 1and 2 mark numbers were evenly divided.
Possibly the power in watts or the cost threw them but more likely was the small amount in the answer; candidates on the right lines ended up with 3600 or 36. Perhaps they could not accept a cost of 3.6p for electricity as the context of a low amount of use seemed to pass them by.

Question 8

(a) As to be expected two marks for the vast majority of candidates. A small number reversed the beta and alpha answers and scored one mark.

(b) Another good differentiating question. A fair number of two mark answers (approximately 40%), a lot of one mark responses and a significant number of zeros (about 1/3rd of candidates). There was confusion between ionisation and ionic bonding in some answers.

Question 9

(a) A variety of answers were given to this question. Poor responses repeated the 'Big Bang' idea with reference to the expanding Universe or referred to the red light, sometimes saying it caused planets to look red. Good answers were quick to the point of galaxies moving away from us.

(b) Too many candidates described the origin of a black hole, 'sucking' / 'pulling in' light or matter to score in this question. A lot (60% or so gained one or both marks available) of very sound answers mainly for the large density and large gravity marking points. Some very poor answers to this question, 40% of the candidates scored zero.

(c) Correctly described in the main but poorer candidates constructed answers around 'time'.

Section C (Module P3)

Question 10

(a) Aimed at 'D' grade and successfully answered by almost all candidates.

(b) A relatively easy two marks for most but an unusually high number wrote 10 ÷ 3 and scored zero.

(c) The vast majority answered correctly in a written answer and drew correctly on the graph.

Question 11

(a) Most candidates completed the sentence correctly.

(b) This calculation was correctly computed by more candidates than the speed calculation in the previous question; just less than 90% gained both marks. A number made a good start but failed to go on and do the division correctly.

(c) Rather than answering in terms of reaching a higher speed or greater speed change far too many answers merely stated that car B was moving at a higher speed. Some answered in terms of distance and also failed to gain the mark. There was a 50 / 50 split in correct and wrong answers.

(d) A source of two marks for a lot of candidates but some failed to be specific and just stated 'speed' or 'mass'. Other weak answers did not specify the car or road conditions (eg brakes / tyres / road). Only one in ten failed to register at least one mark.

(e) A more difficult part of question 11 and very few (only 2%) two mark answers were seen as candidates failed to go on to mention the effect on acceleration. Zero mark responses failed to state whether the braking distance increased or decreased and spoilt potentially sound answers.

Question 12

(a) Often candidates failed to stress the; 'at point of use' idea although the mark scheme was relatively generous on this occasion.

(b) Almost ¾ of the entry gained both marks. The poorer answers failed to square the speed halved the mass and squared (400 x 8) squared the mass and ended up with an answer out by a magnitude of 100 forgot to multiply 800 x 82 by 0.5
However the start was often correct and one mark was then awarded.

Question 13

The success rate for this question was very high with no obvious pattern to the relatively small number of zero scores (1 in 10 did not score). The most frequent error was to invert the division and obtain 25 as the answer which somehow became 0.25 on the answer line

Question 14

(a) The start to the final question was easier than part (b) and most candidates were awarded the mark. Approximately 2/3:1/3 split in favour of correct responses.
When the answer did not deserve credit there was no mention of energy and the response focused on 'force', 'impact' or 'shock'.

(b) A good differentiating question to finish. Many good answers covered all three marking points. Just under half of the candidates did not register a mark. Some weaker answers talked about the car and why the air bag is released rather than the air bag and the driver or were under the impression that stopping time would be reduced and acceleration increased.
Many non-scientific answers referring to the cushioning effect of the air bag were seen from weaker candidates.

B652/01 Foundation Tier

General Comments

This was the second occasion that this examination was available to be sat by candidates. There were 650 candidates and marks ranged from 0 to 47 out of 60. Over half of the candidates achieved a grade C and there was little evidence that candidates had been incorrectly entered for the foundation tier paper.

The mean mark for the paper was 27.6 and the paper discriminated satisfactorily over the target grade range of G to C. The paper gave candidates the opportunity to demonstrate positive achievement in physics.

There was little evidence that candidates had insufficient time to complete the paper but there were some occasions where parts of questions were omitted. Most candidates followed instructions regarding how to answer questions or how many answers to provide. Where they did not do so, if the intentions of the candidate were clear, marks were awarded, however on occasions it was not always clear what the candidate meant so no marks could be scored.

The majority of candidates could perform the calculation and it was pleasing to note that working was usually shown.

Some candidates were not able to apply their knowledge to new situations.

Comments on Individual Questions

Section A (Module P4)

Question 1

(a) This was intended to be a relatively straightforward introductory question and the majority of the candidates scored. A common answer that failed to score was simply a repetition of the question stem – static electricity. Few mentioned electrons but a significant number of those who did, referred to positive electrons.
About half of the candidates could provide a use for static electricity.

(b) This question was well answered with a sizeable majority scoring at least two of the three marks. A common error was to consider nylon as a conductor, less common was the belief that the tap was connected to live.
Most could suggest one way in which static electricity is a nuisance – shocks and hair standing on end being common answers. A significant number believe that static electricity is a power source.

Question 2

This question was well answered with the majority scoring full marks. There were few who did not obtain the correct answer for the value of resistance.

Question 3

(a) There was only one mark for this question and although almost every candidate knew that gamma radiation passed through the skin, many thought that the other type was alpha. X-rays and ultraviolet were also common incorrect responses.

(b) Cancer was the most common answer but a significant number of candidates also knew about other dangers.
Uses of nuclear radiation are generally well known although there is some confusion with ultrasound scanning and a generalised statement about taking X-rays.

(c) Only half the candidates scored this mark. Common misconceptions included mobile phones and vague answers such as atmosphere.

Question 4

(a) This question was not answered well. Fewer than one in five candidates could identify the centre of a rarefaction; the majority choosing the centre of a compression instead. Marginally more candidates knew the distance that represented one wavelength.

(b) Most knew a use of ultrasound; fetal scanning was the most common answer. Some candidates knew about the breaking down of kidney stones.

Question 5

(a) This question was not well answered. Only a quarter of the candidates could name the fuel used in a nuclear power station. Oil, wood, coal, windmills, chicken poo and electricity were suggested answers.

(b) Many candidates made no attempt at this question. Many wrote of heating the fuel, even those who had chosen a nuclear fuel as their answer to part (a).

Section B (Module P5)

Question 6

(a) A surprisingly high number of candidates could not work out which of the three situations represented the highest relative velocity.

(b) The difference between speed and velocity is not well understood. Many candidates thought the circular route represented constant velocity.

(c) The addition of forces was better understood than the areas covered in the first two parts of the question.

Question 7

This question was well answered. Only a few candidates failed to score and most scored at least two of the available marks. There was no pattern in the selection of incorrect responses.

Question 8

(a) An order of magnitude answer for the wavelength of radio waves was not as well known as might have been expected.

(b) Fewer than half the candidates scored this mark. Many gave the reason that radio waves were absorbed by the atmosphere.

(c) Only a small minority failed to identify a dish as the receiver for satellite television.

(d) Diffraction is not well understood. Those who scored a mark tended to do so by showing waves of consistent wavelength. Circular waves were often drawn, but these were not centred on the gap.

Question 9

(a) A minority of candidates knew that a real image is produced by a camera. Common answers included reference to digital, invirtual, realistic, upright and magnified.

(b) Most thought that the image in a camera is produced in the lens.

(c) Convex was the correct and most popular answer for the type of lens used in a camera.

Question 10

(a) The majority of candidates scored at least one mark by suggesting that Hugh moved towards Hannah. Less than half realised that Hannah moved towards Hugh. Many thought she would move backwards. Some candidates wrote that Hugh would move faster than Hannah. Few candidates showed understanding of action and reaction.

(b) Only a handful of candidates failed to score this mark. A good number of candidates did explain a collision in terms of two rugby players.

Section C (Module P6)

Question 11

(a) Just over half the candidates correctly identified a potential divider circuit. There was not one distracter that was more popular.

(b) Most thought that the resistance of a thermistor changes when the current changes.

(c) A straight line graph passing through the origin was the most common response. Of those who showed a negative gradient, only a small minority also showed a decreasing gradient.

Question 12

(a) The symbol for a capacitor is not well known. Most identified it as a cell. A diode symbol is better known.

(b) Only a tenth of the candidates correctly identified the diode as being responsible for rectification. Many failed to answer the question; many named electrical appliances. Some took the hint from the question and correctly identified full wave rectification, but a good number failed to answer the question.

Question 13

(a) Many candidates chose the three correct labels but a good number could not place them in the correct answer boxes. Motor was a common answer for commutator.

(b) Half the candidates scored the mark, usually by writing current instead of the preferred answer of voltage. Magnetic field was a common incorrect response.

(c) There was an even spread of responses from those available.

Question 14

(a) Half the candidates scored both marks but a good number gave 0 0 and 0 1 as their two answers.

(b) Candidates were required to give letters which represented input signals. Those who only gave one letter failed to score. Almost everyone knew the letter representing the output signal. Few candidates completed the truth table correctly. Some had the table half correct. There were a good number of 2s present in the tables.

(c) The job of the latch was not understood. Many confused the electronic latch with a door or gate latch answering in terms of keeping people out.

B652/02 Higher Tier

General Comments

This was a good paper with a relatively high accessibility containing some useful discriminating questions at the key grade boundaries at C and A. There were many opportunities for candidates to demonstrate what they have understood and learned during their course. There was no evidence of candidates running out of time.

The paper was accessible and gave a good range of marks with ample opportunity for candidates to illustrate their application of knowledge and understanding gathered during the course. Section A (Module P4) is of course common ground for those candidates and centres doing additional science. Sections B and C assessed Modules P5 and P6 and these proved more challenging for students certainly in terms of lack of familiarity but perhaps also because of difficulty too. The performance on sections B and C was more centre specific and tended to be lower than the first section.

Comments on Individual Questions

Section A (Module P4)

Question 1

Question 1 was a good starter question on which most candidates scored well.

(a) Relatively few candidates failed to score marks here. Most answers (about 90%) correctly referred to charge or charged. Some answers, though, lacked precision and merely referred to 'static' with no mention of charge at all [0].

(b)(i) Most candidates scored at least 1 mark here by referring to explosions. A further 40% went on to gain the second mark by correctly referring to the idea of the earth removing charge – this was usually only stated and understood by the best candidates.

(b)(ii) This question was answered well with most candidates stating a nuisance of static electricity.

Question 2

Question 2 was about current and household electricity. It was well answered by most but discriminated well in part (c).

(a) Most knew that a decreased current was due to an increased resistance.

(b) Most candidates successfully selected the correct equation for Ohm's law and used it to calculate the resistance, 10 / 2.5 = 4 [2]. Occasional errors were due to either multiplication of 2.5A and 10V [0] or incorrect division 2.5 / 10 = 0.25 [0].

(c) Most candidates gained 1 mark here for the idea of the fuse blowing due to a high current. Alternatively others referred correctly to the idea of the case 'can't become live'. The second mark was at a much higher demand and examiners were seeking to award this if answers referred to the **low resistance path idea** of the earth wire. A few high ability candidates gave good answers for this second mark.

Question 3

Question 3 was about nuclear radiation.

(a) This gave no problems to the majority of candidates who correctly gave beta and gamma as those radiations that pass through skin.

(b) This question differentiated well. Most got the idea of concentration on cancerous cells. The reduced dosage to healthy cells was often not explained concisely. Some gained this mark by stating that the idea that beam was spread (not concentrated) through healthy tissue. More commonly this mark was gained for the idea of rotation around (the body) or occasionally was seen 'fired from different positions' or 'from multiple sources'.
Examiners were instructed to ignore the protection idea of the staff (lead aprons, etc) but give credit for shielding of part of the patient. A few referred to 'wearing a lead face mask' [1]. Some mistakenly thought the patient should wear suntan lotion.

Question 4

Question 4 on radioactivity was a well answered question.

(a) Over 90% of candidates knew that the radiation that is always present was called 'background radiation' and in part **(ii)** most again could explain its origins. Rocks and cosmic rays were the most common answers here. Also allowed and occasionally seen were references to nuclear industry or nuclear medicine.

(b) Just over half knew the nature of a beta particle in part **(i)**. Most could find the half-life [1] and correctly sketch the graph [1].

Question 5

Question 5 asked candidates to order the stages in a nuclear power station. It was answered well by most. Common errors were to get generator and turbine in the wrong order.

Section B (Module P5)

This section (and section C) covered, for many centres areas of the specification which were unfamiliar. This was reflected in the candidates' performance.

Question 6

Question 6 was about vectors.

(a) Over 90% of candidates could identify the correct resultant force from the list.

(b) This part discriminated well. Only 20% failed to score at all in part **(i)**. Better candidates were scoring all 3 marks here by completing the chart correctly. In part **(ii)** most could calculate the final velocity.

(c) In this part, there were very few scale diagrams and success here was mainly due to Pythagoras being used. Over 60% gained both marks here when calculating resultant velocity.

Question 7

Question 7 was about waves and diffraction.

(a) About 20% failed to score at all on the wave diagram. Many got the idea that the wavelength was maintained. Some had the idea of curvature but the focus of this was so inaccurate that this mark was often not awarded. There were relatively few answers correctly showing straight wave fronts with diffracted and curved edges. Circular waves of similar wavelength focussed on the gap could however still gain 2 marks.

(b) This part was about gap size and diffraction. In part **(i)** most knew that reducing the gap size increases diffraction. In part **(ii)** about 40% stated that maximum diffraction occurs when the gap = wavelength. Other answers were occasionally wrong but more often imprecise – eg. 'a small gap' [1].

Question 8

Question 8 on crumple zones discriminated well giving a range of marks from 0–3. Marks were available for the ideas of the collision time increasing [1], force decreasing [1] and for correct reference or use of force = change in momentum / time [1]. A* candidates tended to score all 3 marks here.

Question 9

Question 9 on the spectrum discriminated well, particularly in part (b).

(a) Most gained 2 for the spectrum colours. Many got (red) – orange yellow and green correct for the first part of the spectrum. Slightly fewer were successful with 'blue, indigo and violet'. Indigo was often not named and purple was a frequent response.

(b) About 30% of candidates, perhaps predictably failed to score on this high level question. Marks were available for different colours having different: refractive indices [1], speeds [1] and wavelengths or frequencies [1].
Better answers qualified the change correctly by writing about red light: having a longer wavelength or lower frequency [2], being faster [1] and having a lower refractive index [2].

Section C (Module P6)

Question 10

(a) The great majority of candidates correctly calculated the output voltage of the potential divider.

(b) Just less than half drew the correct curve for the LDR. Marks were available for resistance decreases with light intensity [1] **BUT** a smooth curve drawn with decreasing negative gradient scored [2].

Question 11

Question 11 was about generators.

(a) About half of candidates knew the coils of the generator had to be moved [1]. A few referred to the magnets spinning around the coils [1]. More however referred to putting current into the coil (mixed up with the motor idea) [0].

(b) 40% of candidates correctly selected 'an electromagnet rotates inside coils of wire'. In part **(ii)**, most scored [2] for increasing frequency [1] and increasing voltage [1]. Most also knew the voltage increased as the turns increased in number [1].

Question 12

Question 12 was about electronic gates and this was unfamiliar territory for many.

(a) A third of candidates scored [0] on the truth table for the gates combination but over half, overall completed it successfully.

(b) This was definitely a question which showed centre specific successes. Relays [1] was only seen in about 30% of answers. Most components were named from resistors to capacitors. Transformers was also a common incorrect response. In part **(ii)**, the best candidates scored 2 marks, but this question was found difficult by the majority. Examiners were seeking to award marks for the ideas of only small current / voltage provided by the logic gate [1] and isolation of low voltage / current from the mains [1].

Question 13

Question 13 was a challenging question about diodes and rectification.

(a) Over half of the candidates failed to score on this question about holes. Marks were available for holes having an absence of electrons [1] leaving them positively charged [1].

(b) The bridge rectifier was poorly understood. Examiners were seeking to award marks for the ideas of: diodes letting current pass one way [1] and that the diodes work in pairs [1]. Rarely seen were descriptions of diodes 1 & 4 working together or 2 & 3 working together [2]. In part **(ii)** the sketch graph proved a challenge for many but about 50% did achieve both marks.

B655 Report on Science Skills Assessment

A General Comments

Although this is the second year of this specification, for many centres who did not enter candidates last year, this was the first time work had been moderated.

The Skills Assessment for Gateway is very different from the previous Sc1 Coursework component of GCSE and which represented a 'common assessment element' for all Awarding Bodies. For Science, there are two components Can-Do Tasks and Science in the News.

The new Skills moderators appointed by OCR were provided with training in the new requirements, and it is very pleasing to report that the process of moderation, despite large numbers, went very smoothly and that most of the candidates who were entered gained great benefits from all aspects of the Skills Assessment.

Candidates were entered for Skills Assessment 1 (Can-Do tasks and Science in the News) for Science and separate Biology, Chemistry and Physics.
The table summarises the number of candidates in each specification.

Specification	Subject	Number of centres	Number of candidates
B625	Science	762	90810
B635	Biology	202	7941
B645	Chemistry	150	5536
B655	Physics	148	5419

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 copied each time it is used. Marks cannot be just transferred from one specification to another.

B 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. Although the form gives spaces for dates these are for internal use and are not required by the Moderator.

It is pleasing to report that there were fewer arithmetical errors in Can-Do tasks than in the previous year. If moderators find any mistakes in the sample, the centre will be asked to check the arithmetic of the whole sample. Centres must use the Can-Do tasks in the system, they cannot devise their own. In a separate science e.g. Physics all the Can-Do tasks must be from the 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. Teachers do not need to invent tasks to be done but can download suitable materials.

Initially one task was provided for each module B1, B2, C1, C2, P1 and P2. There were also tasks for B5 or B6, C5 or C6 and P5 or P6. A task set for P1, for example, cannot be used for B1 and a task from P5 or P6 cannot be used for Science.

New tasks have been added to the Interchange website in June 2007 and June 2008 to provide even more choice. There will be a continuing programme for the addition of new topics year by year to keep the specification up-to-date. No task will be removed from the listing during the lifetime of the specification but teachers may decide that some of the tasks have become less relevant with the passing of time. In this way it is hoped that OCR will be able to reflect any changes in the way in which the contents of the course are linked to current scientific issues.

At the initial INSET training sessions '*Should smoking be banned in public places?*' was used as an exemplar task for discussion and development but this was not included in the listing of the tasks available for assessment because it was felt it had lost relevance since the decision had been made and become law. A few centres still used this task for assessment this year and it was accepted so that candidates were not disadvantaged. However, it will not be accepted in future years.

There is the facility for centres to write their own Science in the News tasks. No centre has done this yet and obtained the necessary approval. Centres are reminded that if they want to develop their own SinN tasks they should seek advice from OCR before writing them, and that topics need to be approved before they are used.

There were some problems where centres were attempting to double enter from Entry Level. Tasks that were suitable for Entry Level e.g. Chocolate are not appropriate for GCSE Science.

Administration matters - Supervision of Skills Assessment

Another 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 can read through the stimulus material and explain any scientific words but they must not give any opinion. The stimulus material is not differentiated and the same task is presented to candidates across the whole attainment range. One approach with lower-attaining candidates is to provide only the appropriate parts of the stimulus material, rather than presenting them with the complete document. OCR provides a writing frame which could be used with lower-attaining candidates. Centres are allowed to use their own writing frames providing they are generic i.e. the same writing frame for all tasks. Writing frames are not recommended for more able candidates as it will tend to limit their approach.

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. Too often when reports are read one gets the impression that the candidate has really not looked at both sides of the issue.

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. 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, 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 for relevant aspects on the part of the candidate had therefore been removed. With the previous POAE system it was often felt in Strand A that teachers did not give opportunities for students to select appropriate equipment, it is similar here. The best reports came where students 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, for example, not all candidates having the same bar chart display,
- candidates to answer the question in different ways.

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. There is no automatic penalty for reports that are longer but long reports, often including large sections copied from a website/book etc, may lose the tightly-focussed structure which is required for a clear match to the 6 mark standard in Quality A.

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.

Most of the reports submitted for moderation were hand-written and subsequently photocopied, but centres should ensure that it is possible to read the photocopy and that any annotation by the teacher explaining why particular marks have been awarded is visible. In cases where the photocopy is difficult to read the moderators will automatically return the work to the centre.

Some reports were word-processed and 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
- that no competed report is taken out or e-mailed to another person.

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.

Under no circumstances should any Science in the News tasks be drafted and subsequently redrafted. The report produced at the end of the supervised writing session is what has to be 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 clear evidence that drafting and redrafting went on in a very small minority of Centres. Evidence of drafting and redrafting of

candidates' reports or too much coaching will lead to the work not being accepted for moderation.

C 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 candidates at Grade C and above.

The Tasks can be used throughout KS3 and KS4 and candidates at an earlier stage will clearly benefit from having their positive achievements rewarded. All the teacher needs to do is to record the tasks each candidate achieves. 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.

It is pleasing to see that candidates are taking these seriously and centres are reporting the benefits of motivation of candidates at all levels but especially with lower-attaining candidates.

D Science in the News

Approach

Since Can-Do tasks will not differentiate 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 need to be applied hierarchically. They can only be awarded when the whole statement is fully matched.

It was still clear that in some centres the candidates had not been fully prepared, and they had been given the task to do without a clear idea of what was required. It is also clear that in some centres only one SinN task has been attempted. This does not provide an opportunity for candidates to improve their performance. Some centres conduct SinN under examination conditions. There is nothing wrong with this but it is not essential.

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. 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 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. Several Centres had clearly not internally standardised the marks and consequently the rank order was not valid. In such cases the sample had to be returned to the centre, and it is not desirable for the teachers at centres, 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

whole 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. However, candidates who do not do any research for themselves are able to gain marks in the other five Qualities.

It is important candidates read and prepare to use the source material before entering the supervised session. This could be compared with the way they would prepare for an exam with pre-release material. Reports sometimes show that nothing has been done with the source material before the supervised session. Criticisms of exams with pre-release material are often centred on candidates not using pre-release material fully. This is certainly the case here.

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. A reference such as www.bbc.co.uk does not provide sufficient information but www.bbc.co.uk/science/hottopics/cannabis does. Without this level of referencing it is very difficult to support a match to 4 marks.

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. A good 6 mark report will look at evidence for both sides of the argument. Centres are reminded that 6 marks are awarded for the quality of the research and how it is used, rather than the quantity of research which has been done. Little credit can be given where large amounts from a website are just 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 may also be sent to the moderator as supplementary information, but this is not a requirement. Moderators are expected only to moderate the report. They are not required to look for evidence in research material as this was not produced in the supervised session.

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.

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 done by the candidate. This could be by drawing a

graph, pie chart or bar chart from the data, calculating averages or percentages, or extracting data from a graph. It is important that the processing is correct. A poorly drawn graph with incorrect scales or incorrect average calculations will not gain credit.

Few candidates progressed beyond 4 marks. 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.

One example of a true 6 mark response is when a candidate looks up the population of women in England, Wales, Scotland and Northern Ireland and uses the information to work out the number of cases in each country per million women. They find out that the rate is the same in England and Wales but significantly more than in Scotland and Northern Ireland. The rate is identical for women in Scotland and Northern Ireland. Candidates are not expected to give a reason why this difference exists but just to identify this information. It is appreciated that this represents a high level of processing of data above the level of processing used for 4 marks.

The moderator does expect to see different approaches to the same Task from different candidates within the Centre.

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 where these are totally ignored and so a mark of zero has to be awarded. Candidates found consideration of accuracy difficult in SinN.

For 2 marks the candidate needs to make some comment about the quality of the sources used or the data within them.

For 4 marks the candidate must compare the reliability of different sources and explain why one source is likely to be more reliable than another. There were still few marks above 4 because candidates did not understand what is meant by validity and appreciate that validity can only be considered when reliability has been established.

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.

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.

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.

Quality E (Justifying a conclusion)

All of the tasks are posed as questions and therefore need an answer. There are fewer examples of candidates not attempting an answer to the question this series. No marks can be awarded where no decision is reached. In some cases it is obvious that the decision has been made before the question was studied. The aim is 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. It was still the case that few candidates could do this. It is here that researching sources with different viewpoints becomes helpful.

Quality F (Quality of written communication)

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.

Some reports had been word-processed and a spell-checker obviously used. Candidates do need to take care when using spell-checkers since it can result is significant errors, for example '*..defiantly..*' instead of '*..definitely..*'.

E Summary Comments

The job of moderators is to try to support the decisions of centres. Where the marks are outside tolerance and adjustments have to be made, the work was always considered by at least two moderators.

Moderators were encouraged to provide useful reports for Centres. The moderation was accomplished efficiently and effectively, despite the new scheme and many totally new moderators. Much of the success was due to the work of Team leaders in co-ordinating their teams.

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.

F 2008 Grade Thresholds for B625

The distribution of marks for Science in 2008 was very similar to the distribution of marks for 2007.

Grade boundaries for 2008

	Grade threshold							
	Max. mark	A*	A	B	C	D	E	F
Can-Do tasks and SinN	60	53	**49**	44	**40**	35	30	**25**

Since the same work can be submitted for Science in the News for Science and separate sciences the same 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. A great deal of care was taken to ensure that performance by the two routes was comparable.

The grade thresholds have been decided on the basis of the work that was presented for award in June 2008. The threshold marks will not necessarily be the same in subsequent awards. Some adjustments may be expected as experience with the mark descriptors grows.

Changes to Science in the News Level of Response Grid

Following consultation with teachers and moderators, OCR has made a number of changes to the wording of the Level of Response Grid to assist teachers in interpreting the qualities to be assessed.

The revision to the wording will not have an impact on the number of marks awarded or the standard of the assessment for each quality assessed. This means that any work that has been marked already using the original Level of Response Grid for guidance does **not** need to be marked again.

Centres will be notified of the nature of these changes through a Notice to Centres in October and through our website (www.ocr.org.uk).

B656 Report on Additional Science Skills Assessment

A General Comments

This was the first year in which Research Study, Data Task and Practical Skills were assessed. Similar but not identical skills have been assessed in the past; which both helped and hindered the adoption of the new mode of skills assessment.

In the Research Study candidates were, overall, better at producing Research than was the case when Science in the News was first introduced last year. Experience with last year's tasks clearly helped with this skill. The questions, which focussed skills on a particular area, also helped. On the down side some centres emphasised the similarities at the expense of the differences.
The Research Study involves the answering of five questions after researching to find the information necessary. Below are listed some of the ways centres deviated from this.

- Writing the answers as a continuous piece of prose rather than as five answers.
- Assessing the reliability and validity of sources (this is not necessary although it's a good habit).
- Treating the exercise as a Science in the News task on the topic of the study, ignoring the questions.

In the Data Task, centres already had experience of some of the skills involved from 'POAE' in years gone by. This meant that Quality A and Quality D were quite well done. The Data Task, however, concentrates much more on the data and less on the process of acquiring it. Below are listed some of the common ways in which candidates lost marks.

- Not doing any further processing in addition to the averages.
- Failing to talk about the reliability and validity of the data.
- Concentrating too much on the weaknesses of the method and ways to improve it.
- Putting insufficient detail into the method for Quality E.
- Disregarding the variable identified in Q5.

Candidates were entered for Skills Assessment 2 (Research Study, Data Task and Practical Skills) for Additional Science and separate Biology, Chemistry and Physics.
The table summarises the number of candidates in each specification.

Specification	Subject	Number of centres	Number of candidates
B626	Additional Science	573	63150
B636	Biology	102	2922
B646	Chemistry	97	3598
B656	Physics	109	3565

B Administration

In Science Skills, when the sample of work is sent to the moderator, it has to be sent with the record of Can-Do tasks completed. This record gives a breakdown of how the total mark was arrived at.

For Additional Science there is a cover sheet on which the three marks which make up the Additional Science Skills Assessment should be recorded.

Most centres attached this sheet to the work (though there were still some arithmetical errors). A significant number of centres, however, failed to attach this sheet. This meant that the only way a moderator could know the Practical Skills mark was to subtract the marks from Research Study and Data Task from the total mark. This sometimes gave a total greater than six and made it necessary for the centre to complete a form adjusting the marks appropriately. Centres are requested to ensure that this cover sheet is attached to the scripts requested in future.

Selecting the Correct Task

Only Research Studies and Data Tasks linked to modules 3 and 4 of each subject can be used for skills assessment in Additional Science (B626).

There were a few instances where centres had used tasks linked with module 5 or 6 of a science to assess skills in Additional Science. This is not permitted. The tasks linked with modules 5 or 6 are only appropriate for the separate sciences. In 2008 candidates who had been assessed on inappropriate work were not penalised. This concession will not automatically be available in 2009.

Supervision of Candidates

There is no need for close supervision of the gathering of information for the Research Study. Indeed, this research may be done at home if desired. Nor is there any need for supervision of the collection of data for the Data Task, other than the normal precautions during practical work.

The supervised sessions, however, do have to be supervised. Restrictions for each type of skills assessment are given below.

Research Study

Supervision should be sufficient to allow staff to sign the centre declaration form, stating that the study produced is the candidate's own work, with confidence.

Candidates should not bring into the supervised session any electronic media nor should they have access to the internet or their own areas on the school network. This is to avoid candidates simply copying and pasting work already completed at home (possibly with the help of others).

Candidates should not be allowed simply to copy out a piece of work previously produced. This practice has been used, this year, by a small number of centres.

If candidates word process their study, any direct quotes from books or web sites should be in a different font to make it clear which is the candidate's own work. Quotes should also be identified as such in hand written studies.

Data Task

The same rules regarding level of supervision apply to Data Tasks as apply to Research Studies.

Candidates should not have access to the internet or to textbooks. All that is allowed in the supervised session is as follows.

- The original instruction sheet for the experiment.
- The candidate's own results and any other data set which is to be used.
- The questions to be answered.
- A periodic table and physics formulae sheet if applicable.

This is the same as would be allowed in a written examination.

Annotation

Annotation of scripts submitted for moderation is helpful to both the moderator and the candidate.

It is the job of a moderator, not to mark the work, but to support the decisions made by the centre wherever possible. It is much easier for a moderator to do this if reasons why a certain mark has been given are noted on the work itself.

This is useful particularly where intermediate marks (1, 3 or 5) are given. Brief written comments are more useful than notes like B4 or C5 written in the margin. These brief written notes can be at the point where marks are awarded or separately at the end.

There is no necessity to annotate all scripts, just those which are sent for moderation. It is easier for the Moderator to support the decisions of the centre if the centre explains why the marks were given.

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.

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.ocr.org.uk.

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.

The coursework consultancy service allows centres to send three pieces of marked skills assessment of each type to be checked by a senior moderator. The moderator will send a report providing feedback on the marking. It is rare for a centre which has used this service to have their marks adjusted. Photocopied marked work should be sent to the science team at OCR in Cambridge.

C Research Studies

Many centres had candidates who scored well in this part of the skills assessment. Where candidates did less well it was because:

- they did not give full URLs for their sources.
- they did not refer to their sources within the answers to the questions.
- they answered the questions in insufficient detail.
- they relied too much on quoting sections of web sites or textbooks.

Unlike Science in the News Tasks, where the research is 'open ended', Research Studies have questions which must be answered. These questions are not for guidance, they require answers. It is best if the candidates give numbered responses to the numbered questions. If they are written as essays, it is easy for a candidate to miss something essential. It also makes the study less easy to mark and to moderate.

These are Research Studies and research does need to be done. In some cases, it is possible to answer the questions set without doing a great deal of research. The answers given in these cases are unlikely to be good enough to achieve higher marks, something beyond or in greater detail than the content of the specification is required.

Candidates who were 'over-prepared' for the study tended to do less research and to score lower marks.

Quality A (Collecting Information)

This has to do with the research part of the study. The questions guide the candidate as to what research needs to be carried out. Since the topics of the studies lie outside the content of the specification, some research is always necessary.

Two marks can be gained without any sources being given as long as it is clear, from the answers, that some research has been done.

To gain four marks sources must be given and must be given in full. For an internet site this means the full URL for the page(s) used. A moderator needs to be able to check the source should this prove necessary. At least two sources should be given. It should be clear that the sources have been used in the study.

To gain six marks for this skill the sources must be referenced within the text of the study so that it is clear where the information used came from. These references need to appear in the answers to all five questions.

Quality B (Interpreting Information)

In many Research Studies there is some simple interpretation involved in the first two questions. Correct interpretation here can give marks at a low level but is not sufficient to achieve a mark of six. Higher marks can only be achieved by the use of scientific explanation in answer to the later, more open ended, questions.

To achieve the higher marks the science used must be correct and it must be understood by the candidate. It is not sufficient to include only a quote, or a paraphrase, of the web site, however relevant to the answer it may be. A candidate needs to show understanding either by adding content of their own or by internalising the information and writing in their own words.

Maximum marks were sometimes given for quotes from sources which were not entirely relevant to the question asked. The maximum mark available for a relevant quote from a web site would be four.

For six marks the science used must be correct, relevant and written at a level which clearly shows that the candidate understands what is being written.

Evidence for this skill could be found in the answers to any of the questions but full marks would not be available if only some of the questions were answered.

Quality C (Developing and Using Scientific Ideas)

This skill links with the topic of the study. Answers to one or more of the questions will involve the application of the science in the study to either issues of current importance, everyday applications, development of ideas and theories or theoretical explanation of facts.

The quality and completeness of the answers provided here is the discriminating factor which decides on the level of the marks given. It is unlikely that an adequate answer can be found in a book or on the internet. An individual answer written in a way which demonstrates the candidate understands the issues involved and in which the candidate makes relevant and, where appropriate, original comments is required for 6 marks.

Quality D (Quality of Written Communication)

Centres usually had few problems assessing this skill but there are dangers.

Credit has, on a significant number of occasions, been given for the quality of the English in passages copied from the internet. In these cases the quality of the English in the more open ended questions later in the study does not match up. It is the candidate's own work which should be used to decide the level awarded.

Competent use of English is not sufficient for the higher marks. There must be significant and correct use of scientific and technical vocabulary.

In centres with many very good candidates, weaker candidates are sometimes under-marked because they do not measure up to the high standards exhibited by the majority. To a very limited extent the same problem is observed in centres with a large number of weaker candidates.

It is important to mark according to the criteria not comparatively within the centre.

D Data Tasks

Data Tasks consist of a practical task and five questions, each linked to one of the skills being assessed.

Since the completion of the practical task is not assessed, it can be adapted to suit the facilities at the centre. However, care must be taken to ensure that the variables measured and controlled are the same and that the adapted method generates data which allows the five questions to be answered.

It is recommended that the questions be answered in the order given in the task and that care be taken that the answers given fulfil the criteria for assessment. This is particularly important in

Quality E where a significant number of centres treated it as merely a way of suggesting further work. Although questions are linked to skills, marks for each skill can be scored in other questions.

Many centres opted to use only the fall-back data. This was done for a variety of reasons. Sometimes it was because the results obtained by the students were not good enough to provide a reliable conclusion, sometimes it was to make the whole exercise more straightforward.

It is definitely to the candidate's advantage to have their own results in addition to the fall back data. Alternatively, a set generated by the teacher or a set generated by the class as a whole could be used.

If their own data were insufficient leading to the use of the fall-back data, it is still a good idea to include the candidates own data to enable a better evaluation of the data for Quality C.

Quality A (Interpreting the Data)

Candidates usually scored well in this quality with many scoring full marks and few less than four. Where marks were lost it was usually due to errors in plotting, too small a graph or, most frequently, an inappropriate line.

It was pleasing to note that, other than where appropriate, 'dot to dot' graphs were rare. It was sometimes the case that 'best fit' straight lines were drawn where a curve was clearly more appropriate and 'best fit' straight lines were sometimes just straight lines paying little regard to the position of the points.

Marks are given for an appropriate means of displaying the data. This is nearly always a graph. Graphs should have correctly labelled axes with the controlled variable on the 'x' axis and the dependant variable on the 'y' axis. The graph (not just the axes) should occupy at least half of an A4 sheet. Plotting should be accurate to half a square. An appropriate straight line or curve should complete the graph. An appropriate line is one which fits the data obtained unless the candidate could be expected to know that a particular relationship should produce a straight line.

A table of results on its own is rarely worth any credit as the format for a table is usually given and a table alone is not the most appropriate method of recording the data.

The candidate's raw data and the averages should be given as well as the graph. There were some occasions, this year, where centres did not include the raw data which made the checking of averaging and plotting impossible.

Quality B (Analysis of the Data)

Finding patterns and trends presented few difficulties for most candidates. Sometimes a full description was lacking which limited the mark obtained. Sometimes a straight line was taken to mean direct proportionality, which, of course, need not be the case. The processing part of the criteria could be satisfied by the simple processing included within the task e.g. averaging. It should be noted, however, that incorrect processing should not be given credit. Four marks was usually secure but a real score of six was rare.

To score six marks additional processing is necessary. This additional processing must lead somewhere. One place it could lead is to the discovery of an anomaly but it is not sufficient to spot an anomaly by examining the graph or the raw data. Neither is it sufficient to do some extra

processing e.g. calculating a gradient and combine it with the detection of an unrelated anomaly. The further processing must lead to additional information.

Where six marks were validly scored it was usually by assessing the validity of the data. This was sometimes done by quantitatively comparing two data sets and showing agreement or otherwise (this could be own data with the fall-back data or two sets of class data). It could also be done by assessing whether a best-fit straight line showed proportionality when the exercise should have shown this. An anomaly could be detected by calculating a theoretical value and comparing it with the experimental value obtained.

Quality C (Evaluation of the Data)

This skill was also often marked over generously. Centres should note the wording 'Evaluation of the Data' not of the method.

Data is reliable if it is consistent. If all three repeats of a particular value concur then that data is reliable, whether or not it is accurate. If the values do not concur it is not reliable. In Data Tasks where there are no repeats proximity to the best fit line could be used instead. This is part of the skill, the other part does refer to the method and comments should be made as to how the method used resulted, or did not result, in reliable data.

The assessment grid is hierarchical and both parts need to be present to score four marks. Many candidates produced a very thorough description of the limitations of their method and suggested suitable improvements but only scored three marks.

To achieve six marks the validity of the data needs to be discussed. This was rarely seen in studies moderated. Validity has to do with whether the data are sufficient to give a firm conclusion. Comparing two data sets to show concurrence or comparing quantities calculated from the data with known values could show this. It doesn't matter whether the data is valid or not, as long as its validity is assessed.

Quality D (Justifying a Conclusion)

Centres were usually quite accurate in assessing this part of the Data Task. There was sometimes a tendency to give too high a mark for a conclusion which was correct science but which was not really linked to the data which had been produced.

It is important that the science used in explaining the trends and patterns observed is correct and that it explains all of the trends and patterns completely.

To gain six marks the explanation should also be set out logically, demonstrating understanding of the science involved.

Quality E (Planning Further Work)

Gaining full marks in this quality was a rare occurrence. There were a number of problems, all regularly seen.

- The further work planned had little to do with the question asked.
- The further work was planned in insufficient detail.
- The second part of the question was not addressed.

Centres are reminded once more that the assessment grid is hierarchical so, if there is insufficient detail in the method, the maximum mark which can be scored is three.

If the work planned does not address the question asked then no marks can be scored.

The detail has to be sufficient to allow a third party to carry out the intended experiment. It is not necessary to write a full page of very detailed instructions but the following basic information must be included.

- What variable will be changed and how.
- What variables will be held constant and how.
- What range of reading will be taken.
- How the data obtained will be treated.

The method used for the original data task can be used as a starting point to save having to give a detailed description of apparatus. Candidates are not expected to devise a totally new experimental method but to adapt the method already used.

The discriminator which decides whether more than four marks can be scored is an appreciation of how the results of the experiment increase understanding of the topic. This can usually be achieved by a good answer to the second part of question 5.

E Practical Skills

This is a mark given by the centre as a summary of the practical skills demonstrated by each candidate over the period of the course.

The intention is to gain a general impression rather than to have a snapshot of the skills on a particular occasion.

Some centres had a good range of marks but it was surprising to see how many centres had a complete cohort all scoring six marks.

F Separate Sciences

The problems and successes noticed in work submitted for the separate sciences were the same as for Additional Science in both Research Studies and Data Tasks.

The overall scores tended to be higher because, in general, candidates were of higher ability.

It was rare to see examples of Research Studies and Data Tasks from the units attached to the separate science (modules 5 and 6) and some were not seen at all.

Many of these skills exercises provide interesting ways of delivering and enhancing the separate science units. I hope to see them used more next year.

G Grade Boundaries

Grade	A*	A	B	C	D	E	F
Mark/60	52	47	41	36	30	24	18

Since the same work can be submitted for Additional Science and Biology, Chemistry or Physics the grade boundaries apply for B626, B636, B646 and B656. Approximately one third of the separate science cohorts used Additional Science Skills Assessments rather than Science Skills Assessments. A great deal of care was taken to ensure that performance by the two routes was comparable.

The grade thresholds have been decided on the basis of the work that was presented for award in June 2008. The threshold marks will not necessarily be the same in subsequent awards. Some adjustments may be expected as experience with the mark descriptors grows.

Grade Thresholds

General Certificate of Secondary Education
Physics B (Specification Code J645)
June 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B651/01	Raw	60	-	-	-	38	30	23	16	9	0
	UMS	69	-	-	-	60	50	40	30	20	0
B651/02	Raw	60	45	38	30	23	16	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B652/01	Raw	60	-	-	-	28	23	19	15	11	0
	UMS	69	-	-	-	60	50	40	30	20	0
B652/02	Raw	60	44	37	30	23	16	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B655/01	Raw	60	53	49	44	40	35	30	25	20	0
	UMS	100	90	80	70	60	50	40	30	20	0
B656/01	Raw	60	52	47	41	36	30	24	18	12	0
	UMS	100	90	80	70	60	50	40	30	20	0

B655 & B656 - The grade thresholds have been decided on the basis of the work that was presented for award in June 2008. The threshold marks will not necessarily be the same in subsequent awards.

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J645	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J645	23.6	53.9	78.9	93.7	98.1	99.3	99.7	99.9	100.0	8818

8906 candidates were entered for aggregation this series

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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