

**Physics B J645**

**Gateway Science Suite**

General Certificate of Secondary Education

**Report on the Units**

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**June 2009**

**J645/MS/R/09**

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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

Ofqual produced a public report on GCSE Sciences in March 2009: 'Findings from the Monitoring of the new GCSE Science Specifications: 2007 and 2008'. This report (page 25) makes reference to an agreement between Ofqual and the Awarding Bodies 'to ensure that grade boundaries are set appropriately'. Part of this agreement required all the awarding committees to work towards a new national standard for this summer's series. This has had an impact on both the examined units and the coursework components awarded this summer, and has resulted in higher thresholds than might have been expected for a number of the key grade boundaries, across the Gateway Science and 21<sup>st</sup> Century Science suites of specifications.

Several examination sessions for these papers have been set, 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. 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. 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 for short prompted responses. These are often 'choose from a list' type questions. Usually, it is the case that they are attempted. The distractors in these papers are 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 for candidates to use their time to check for such omissions. These types of question are not always targeted at the lower grades on a paper. For example questions on star cycles can often follow this format.

Calculation questions, as a rule, are being completed increasingly well. This is partly due to the formula being present on the paper. However, they 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 a calculator
- Dividing the numbers the wrong way (or is it the easy way?).

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.

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 they in class situations they can routinely and purposefully advise their students.

## B651/01 Foundation Tier

### General Comments

The paper was accessible to all pupils. Examiners reported very few weak scripts. Similarly there were few outstanding scripts and centres should be congratulated on entering their students for the correct tier. The entry this year was approximately double that of last year with a clear movement into the separate sciences.

The mean for the paper was 36 and the standard deviation 6.9 producing a tight distribution of marks.

### Comments on Individual Questions

#### SECTION A – MODULE P1

##### Question 1

This question was about shock waves. There was a poor understanding of this topic.

- (a) The majority of candidates gave the correct answer seismometer.
- (b)
  - (i) Proved much more difficult with only about 20% of candidates answering this part correctly.
  - (ii) Only about a third of candidates knew that s-waves only travel through solids.
  - (iii) Was testing the fact that p-waves travel faster than s-waves. About half the candidates gave the correct answer of 6000m/s.

##### Question 2

- (a) Candidates were able to write about wireless technology and most explained that it was portable and did not need to be plugged into an electrical supply.
- (b)
  - (i) Whilst the most common answer was reflected from the walls a significant number of candidates thought infrared was digitalised by the walls.
  - (ii) Examiners were instructed to accept TV remote as an answer even though it is not actually controlled by IR radiation. This was the most popular answer. Correct answers include automatic doors and of course televisions themselves.
  - (iii) Only half the candidates gave the correct answer C. A was the most popular incorrect answer.

### Question 3

- (a) (i) Candidates were asked to mark M on the graph to indicate where the ice was melting. Whilst the majority put the M on the horizontal part of the graph several put it at the end of the horizontal line. Examiners, in these cases, were instructed to look at the answer to (a)(ii) to see if they meant the constant temperature part of the graph. About a quarter of the candidates were able to explain that there was no temperature change in melting so explaining their positioning of M. Examiners did not accept “the line is straight/flat” as a sufficient answer.
- (b) Examiners were expecting degree Celsius. They accepted other temperature scales or symbols provided the degree symbol appeared before the letter as in °C. They did not accept the degree symbol after the C or the F.
- (c) Proved difficult even though it was a standard definition of specific latent heat. Almost half the candidates scored 1 out of 2, usually for the second word temperature and about half of these scored the second mark for energy as the first word.

### Question 4

- (a) Examiners were looking for a statement that air is an insulator but surprisingly only about 30% got this question correct.
- (b) The majority of candidates knew that IR was reflected by shiny foil.
- (c) Less than a quarter knew that radiation was the type of energy transfer reduced by foil.
- (d) Good answers with only about 4% failing to score and the majority scoring full marks.

## SECTION B – MODULE P2

### Question 5

- (a) Most candidates thought that a solar panel was a different way of making electricity from the sun compared to a photocell and did not score in this part.
- (b) The majority correctly gave the answer as renewable.

### Question 6

- (a) Most candidates put the statements in the correct order.
- (b) (i) Proved straight-forward with most candidates giving the correct answer of 10 volts.
- (ii) Proved more difficult with only the better candidates giving the correct answer of 0.04 seconds. There were several careless mistakes noted by examiners where answers of 4 or 0.4 had been given.

### Question 7

- (a) (i) Most candidates were able to name another fossil fuel, of those who failed to score the most common incorrect answers were diesel and petrol as these were oil derivatives.
- (ii) Most candidates did not answer the question on the paper which asked for a renewable *fuel* and gave a renewable energy source such as wind, wave or sun. Correct answers include straw, manure, biomass etc.
- (b) Candidates performed well in the calculation with most producing the correct answer of 2970 W.

### Question 8

- (a) The majority of candidates correctly linked one radiation with its use but only approximately 1 in 5 were able to link all three. The most common mistake was to link alpha with the paper thickness gauge.
- (b) About half of the candidates correctly described one harmful effect of nuclear radiation. The most common correct answers were damages living cells and causes cancer. Candidates should be advised to avoid single words such as cancer as examiners were instructed not to credit the word on its own as its meaning was unclear - it could have meant *treat* cancer or *cause* cancer.

### Question 9

- (a) Most candidates gave a correct use for artificial satellites.
- (b) Surprisingly, a third of candidates did not know that the moon was a natural satellite.
- (c) Carried two marks. Candidates should be advised to look at the number of marks and provide an equal number of marking points. Whilst two thirds of candidates gave one reason only one third went on to give a second valid reason.

### Question 10

- (a) Most candidates identified rock as the main constituent of asteroids. Some candidates gave two answers which was a contradiction.
- (b) 90% of candidates correctly described NEOs giving the answer A.
- (c) About one third of candidates knew that stars started from a cloud of dust and gas. The most common incorrect answer was 'little bang'.

## SECTION C – MODULE P3

### Question 11

- (a) (i) This question has appeared many times and in several different forms. Surprisingly only 50% of candidates were able to identify the correct measuring instrument for distance. Examiners were looking for measuring tape or trundle wheel or a description of the device. Because of the distances involved, and in line with previous papers, they did not accept ruler or metre stick as correct answers.
- (ii) 90% of candidates gave stop watch or stop clock as a correct answer. Again as in previous papers the word watch or clock on its own was not an acceptable answer.
- (b) The calculation in part (b) proved more difficult than usual. The correct answer was 16m/s however a significant number of candidates mis-calculated the distance as  $9 \times 4 = 36\text{m}$ . To be fair to these candidates, they were only penalised once for the mistake and were awarded 2 marks if they produced an answer of 18m/s.

### Question 12

This question was about gravitational potential energy and kinetic energy on a roller coaster.

- (a) Whilst A was the most popular and correct answer a significant number of candidates chose the answer E.
- (b) Few candidates realised that the car was moving fastest at the lowest point of the ride (answer C). The most popular and incorrect answer was B half way down the slope.
- (c) The majority of candidates were able to calculate the kinetic energy correctly (400kJ).

### Question 13

- (a) (i) This question has been asked many times before and candidates are still failing to answer the question correctly. In order to score the candidate needs to make clear that it is a *distance that* is needed. The majority of candidates started their answer *with* “the time taken..... “ or “how long it takes...” so immediately ruling out any marks. The expected answer was “the distance travelled between seeing the danger and applying the brakes”.
- (ii) Whilst more candidates answered this part correctly the majority of candidates again started with “the time taken .... “ or “how long it takes .....”. A simple answer of the distance travelled from applying the brakes until stopping was expected.
- (iii) Most candidates correctly added the two distances together to give 12m.
- (b) (i) The majority of candidates correctly identified a change of speed as acceleration.
- (ii) The majority of candidates gave the correct answer C for this question.



#### **Question 14**

Most candidates answered with the idea that the seat belt or airbag provided restraint e.g. stopped the person hitting the windscreen etc, for one mark, but failed to gain the second mark by describing how, for example air bag inflates, seat belt stretches. Higher level answers in terms of absorbing energy/increasing collision time were credited.

#### **Question 15**

This question was about falling freely under gravity.

- (a)** The majority of candidates correctly stated that the speed increased after he left the aeroplane.
- (b)** Candidates identified gravity as the force causing him to fall.
- (c)**
  - (i)** Most candidates indicated that air resistance caused him to travel slower than expected although this was difficult for many to express. Examiners were therefore asked to mark a simple statement “slows him down” as correct and in line with the specification statement.
  - (ii)** Most candidates knew that Steve had to become more streamline and described this in a variety of ways.
- (d)** Almost all candidates scored on this with the answer opened his parachute.

## B651/02 Higher Tier

### General comments

The standard of the candidates work was good overall with the levels of knowledge and understanding displayed in answers to the questions showing that centres had prepared their candidates well. The level of performance in the three modules being assessed (P1, P2 and P3) was reasonably consistent, with no module being particularly strong or particularly weak. The standard of mathematical skills was satisfactory apart from the weakest candidates. However, when a more difficult computation was required some candidates were less successful as in questions 9 and 13(c).

There were, as always, areas of weakness that are difficult to pin down in terms of why that should be the case, these areas are highlighted below and elaborated on in comments on individual questions:

- use of satellites in communications
- solar heating
- off peak electricity
- cosmic rays
- use of light years
- free fall and terminal velocity.

However, this should not detract from the performance of the large number of candidates who consistently worked at a high standard throughout the examination paper. Very few candidates were wrongly entered for the Higher Tier paper although there were some. There was no evidence that candidates had insufficient time to complete the paper.

### Comments on individual questions

#### SECTION A – MODULE P1

##### Question 1

- (a) This overlap question, although giving most candidates (approx  $2/3^{\text{rds}}$ ) their first mark, yielded a large variety of incorrect responses such as 'latitudinal', 'shortitudinal' and 'latituda'.
- (b) Another overlap question that produced a very high success rate on the higher paper.
- (c) The mark was awarded to the majority of candidates (7 out of 10) but a minority chose 4 000 or 3 000.
- (d) This question was targeted at the higher grades and some candidates did struggle to express their ideas. However, a large number clearly understood both the nature of s-waves and the structure of the Earth and wrote impressive answers. Some candidates thought that s-waves travelled through liquids and their answers were the wrong way round so scored zero. Answers occasionally contradicted the candidates answer to (b).

## Question 2

- (a) A variety of answers but most responses were 'phones' or 'mobiles'.
- (b) Far too often the candidates answered in terms of 'reflected off the satellite'. This often resulted in no score but sometimes the candidate redeemed themselves with a transmitted or retransmitted mark. The weaker candidates could not distinguish between transmitting and receiving. The mark for what the satellite did (i.e. processed the signal in some way) was almost never awarded. It was surprising to see so many poor answers when questions about using the ionosphere for transmitting signals have produced very good responses in the past.

## Question 3

- (a) (i) Testing the concept of specific latent heat with unprompted questions has previously caused candidates to struggle. Obviously the style of question enabled the candidates to regularly gain one or both marks (over 80% gained one or both marks). One mark answers usually gave 'energy' and 'mass' whilst answers with zero marks usually answered 'mass' and 'state'.
- (ii) The breaking of inter-molecular bonds was well understood by only the best candidates (only 1 in 5 gained the mark). Too many gave '**breaking** the molecular **forces**', which was not worthy of credit.
- (b) The calculation was correctly processed by a large number of candidates. Many answered '4.2' without indicating that they had worked in grams therefore gaining only one mark. The use of kJ in the question may have not been well understood.

## Question 4

- (a) The answers here were generally poor with far too many answers merely restating 'it's a poor conductor'; information which was in the stem of the question, or giving 'it's an insulator'. Convection was only present in the answers from the most able candidates.
- (b) As in an earlier question the question style greatly helped the candidates. Consequently, most were successful in gaining the mark. Conduction was the most common wrong choice from the list. Unfortunately some candidates made the correct choice then crossed it out and circled 'conduction'.
- (c) The unprompted question resulted in a variety of answers. Most gained the two marks, errors that were seen were;
- **temperature:** heat energy/heat given out/energy of particles/<sup>o</sup>C/Celsius
  - **heat:** heat given off/J/Joules/change in temperature.
- (d) (i) The vast majority of candidates gained both marks on offer either for 0.25 or by successfully calculating **and** clearly showing 25%. The candidates that only gained one mark put '25' without showing the % symbol. Zero scores were rare, usually because the ratio was the wrong way around.
- (ii) Candidates struggled to answer this effectively usually only stating that the fire heated the whole room. Answers describing **increased** convection or radiation **in all directions** were extremely rare.

## SECTION B – MODULE P2

### Question 5

- (a) This question was clearly related to the second part of the question. Candidates struggled to express their thoughts and hit the marking points, despite seeming to be a relatively easy concept. There was a large range of acceptable answers reflected by the comprehensive list in the Additional Guidance of the Mark Scheme. The obvious response of 'rises in the east and sets in the west' proved popular as did 'the light comes from the south' and 'they are facing the Sun' all of which, together with answers only referring to heat, scored no mark. However, approximately 2/3 of the candidates were able to gain the mark.
- (b) As in previous papers where passive solar heating has been assessed the responses were generally poor with just over 20% gaining two or three marks. Indeed, 40% of the entry failed to register any mark. Answers were often weakened by no reference to IR or by using UV in the answer. Too many answers started by stating that energy or light was absorbed by the glass. The idea of absorbing radiation and then re-emitting was poorly understood, whilst the idea of the emitted radiation being of a **shorter wavelength** was very rarely expressed by candidates.

Too many answers concentrated on solar panels, mentioned the greenhouse effect or described convection in the room. Centres need to re-assess their approach to the teaching of passive solar heating if there is to be any clear improvement of the quality of answers in this topic. This was a question that presented a large degree of stretch and challenge and gave a high level of differentiation.

### Question 6

- (a) (i) A very high success rate with this question.
- (ii) Again most candidates gained this mark; some gave 0.4, 0.02 or 10.
- (b) (i) The use of a step up transformer was well known, the vast majority of candidates giving the correct response. Incorrect responses were; AC/DC/step down/step up and step down /generator/turbine. Occasionally poor attempts to describe the step up transformer failed to score.
- (ii) This part of the question was more searching and candidates often missed the point with answers referring to safety and 'so that voltage (or current) can reach consumers'. Often there was confusion between current and voltage. A much lower success rate than in part (i).
- (c) A large proportion of the entry gained both marks, reflecting candidates' confidence in performing calculation questions.
- (d) Knowledge of 'off peak' electricity was not too impressive although two marks were awarded frequently. Too many answers were vague and did not hit the points in the Mark Scheme. The mark for 'disadvantage' was often not gained due to answers that 'off peak' electricity: is less efficient; did not supply the same electricity/energy; caused electricity to be lost; produced too much noise at night; is a fire hazard. Most correct answers for the second mark were about inconvenience although some wrong answers were given that showed that these candidates thought that **no** electricity was available outside of 'off peak' hours. Few zeros were recorded (approximately ¼ of the candidates) usually because the first response given was that the electricity was free or all things do not work on it.

### Question 7

- (a) For an objective question, which overlapped with the foundation tier, this gave a surprisingly high level of differentiation as a significant number of candidates reversed the correct alpha and beta uses. Some scored zero when gamma was linked to 'smoke detectors' and beta to sterilising equipment.
- (b) The level of recall in this question was poor. Answers about 'waves' or 'rays' were common whilst better attempts that mentioned particles failed to include speed, charge or energy.

### Question 8

Throughout this question there was too much reference merely to planets (or the Earth and the Solar System) rather than to the greater cosmos.

- (a) Although the question tested material from the Standard demand section of Item 2h in the specification candidates often found difficulty in putting down evidence for the Big Bang theory. Candidates often re-worded their first answer or included in their responses:
- descriptions of the asteroid belt
  - explanation/evidence for the Earth-Moon system
  - galaxies or planets moving to the red end of the spectrum or 'becoming' red
  - galaxies being red shifted
  - Answers including residual background radiation were extremely rare.
- (b) Similar to 7(a) in the variety of incorrect answers selected from the list.
- (c) (i) There were many good answers (over half gained the mark) although some answers only gave 'distance'. Poor answers stated that it was a time or that it was the distance to the Sun or a (named) planet.
- (ii) Often it appeared to be language that prevented the gaining of the mark here. Other measurements too small; uses less numbers and references to measuring distances between planets, characterised poor answers.

## SECTION C – MODULE P3

### Question 9

This was the one calculation on the paper that caught out a lot of candidates. Far too many used 36m and answered 18m/s and failed to score maximum marks. Weak answers calculated  $4 \div 2 = 2$  m/s so failing to gain even one mark.

### Question 10

- (a) A high level of attainment, C or E the popular wrong choices.
- (b) Similarly, a high level of attainment, A or E the popular wrong choices.
- (c) This proved more challenging although over half of the responses gained the mark. Halving to answer 100, restating 200 or quadrupling to give 800 were the mistakes made.

### Question 11

- (a) Despite the large amount of information at the start of the question the vast majority of candidates gained the first mark in this question. Unsuccessful responses merely answered in terms of; 'lots of children outside of the school', 'children getting dropped off' or 'lots of parents in cars near the school'.
- (b) (i) Almost all candidates gained this mark (approximately 75%).
- (ii) The majority of candidates easily gained both marks. Those failing to gain marks did not state **greater** speed or gave poor visibility or bad weather. A small number of candidates offered factors that would **reduce** thinking distance. Very few zero marks were recorded.
- (c) The final part of this question was more demanding, differentiating well between candidates.

Many candidates gained the first mark for reduced friction and a related cause type of answer but few went on to give a second example or gain the kinetic energy/momentum mark. Some potentially good answers often gave a 'situation' but then failed to offer a correct explanation. There was a good level of stretch and challenge in this question.

### Question 12

- (a) Similar to the previous comment about question 11(c); more demanding, good differentiation and only the most able candidates gained both marks (slightly over  $\frac{1}{4}$  of the candidates). Answers that were not successful included, or were constructed around; absorption of 'energy' (and/or force) but this was in the stem of the question. Descriptions of cushioning the force or impact often failed to register a mark.
- (b) A very high level of access to this part of the question (over 90% were awarded the mark).

### Question 13

- (a) This was another question that produced a fairly high level of differentiation. When the candidates failed to name the forces (or used upthrust) they rarely registered a mark. Using energy or g.p.e caused many candidates to drop the first mark whilst increasing air resistance with no reference to speed often meant that this mark was not secured. Vague mention of unnamed forces balancing also regularly produced no award for this marking point.

Some candidates were clearly confused between the terms 'mass' and 'weight'. Candidates found the question challenging and this resulted in a satisfactory spread of marks.

- (b) A very low rate of mark award, re-stating the question points about potential and kinetic energy and failing to answer the question. The making point that was hoped for (P.E. does work against friction) was rarely if even seen.
- (c) The final calculation produced a satisfying conclusion to the paper for the majority of candidates (only one in three did not register any mark). One mark answers failed to do the division correctly whilst zero score answers divided the g.p.e. by 85 then multiplied that answer by g (10).

## B652/01 Foundation Tier

### General Comments

This was the fourth occasion that this examination was available to candidates. There were approximately 625 candidates and marks ranged from 4 to 53 out of 60. Candidates generally appeared to have been correctly entered for the foundation tier paper and all had the opportunity to demonstrate what they knew and understood.

The mean mark for the paper was 30.7 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 number of instances where parts of questions were omitted. Some candidates were unable to follow instructions regarding how to answer questions or how many answers to provide.

Candidates are 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.

### Comments on Individual Questions

#### SECTION A – MODULE P4

##### Question 1

- (a) Three quarters of candidates knew that charges were either positive or negative. Common errors included static coupled with kinetic.
- (b) Only half the candidates appreciated that the pieces of paper moved towards the charged comb. Many thought they were repelled or just became charged.

##### Question 2

- (a) This was surprisingly well answered. Many candidates scored two or more marks. Those who did not, were often vague in their answers mentioning the precipitator as being charged.
- (b) Many candidates knew about defibrillators as being a use of static electricity and frequently used the word, although the spelling was sometimes not quite perfect.

##### Question 3

- (a) Almost all candidates scored full marks and correctly calculated the resistance as  $4 \Omega$ .
- (b) The addition of another cell into the circuit seemed to confuse candidates at all levels. Just over half the candidates at each grade correctly stated that the voltage would increase. Few thought it would stay the same. The remainder thought it would decrease. Examiners were not sure whether candidates were guessing the answer or looking for something beyond the obvious answer.

#### Question 4

- (a) A third of candidates correctly identified compression as the area of high pressure. Rarefaction and frequency were common misconceptions. A larger number of candidates knew that rarefaction was the area of lower pressure.
- (b) There were many correct answers suggesting foetal scanning as a use of ultrasound.

#### Question 5

Many candidates scored full marks. The most common error was to refer to a chemical instead of a chain reaction.

#### Question 6

- (a) Whilst many knew that cancer could be treated with gamma rays, few could identify gamma radiation as a transverse or electromagnetic wave. The most common description was as a radioactive wave.
- (b) Only a quarter of candidates could describe what was meant by the activity of a radioactive substance.
- (c) There were many incorrect answers to the use of alpha radiation; smoke alarm was the most common correct response.

### SECTION B – MODULE P5

#### Question 7

- (a) Total internal reflection does not appear to be well understood. Most candidates provided one of the two answers but it was rare to see both.
- (b) Two thirds of the candidates know that light is refracted when it passes from glass into air. The remainder believe it to be either reflected or absorbed.
- (c) Many candidates showed a reflected ray but also included a refracted ray when the angle of incidence increased to be larger than the critical angle.

#### Question 8

- (a) Three quarters of the candidates could list two uses of artificial satellites. Those who failed to score a second mark either gave two communications examples or wrote a vague answer (e.g. weather) instead of a more precise answer (e.g. monitoring weather).
- (b) (i) Only two thirds of candidates knew that a geostationary satellite takes 24 hours to orbit Earth. Many wrote 12 hours whilst others chose other numbers from the question, either 36 000 or 20 000.
- (ii) Many thought that a satellite closer to Earth took longer to orbit. It was common for candidates to answer in terms of speed by stating that the satellite travelled faster. This answer was allowed, but candidates should be advised to read questions carefully and answer them as set.



- (c) Only a third of candidates knew the term centripetal. Whilst some selected centrifugal, orbital was the most popular choice for the name of the force keeping an object moving in a circle.

### **Question 9**

- (a) The definition of speed is well known.
- (b) Over half the candidates could provide an explanation for why average speed and maximum speed were different. Many had not read the question and stated that the train was only travelling at 50 km/h.
- (c) This question discriminated well. Some candidates subtracted the two speeds, others found the average. Only the more able candidates correctly added the speeds together to find the relative speed.
- (d) Few knew the difference between a scalar and vector quantity.

### **Question 10**

- (a) Most knew the reason for radio stations interfering.
- (b) Candidates obtained marks by describing what was heard and not for the reasons. Many candidates believe the loudness and quietness is due solely to the distance from the loudspeakers rather than interference between them.

### **Question 11**

- (a) Almost every candidate knew that an aerial is needed to receive radio signals.
- (b) Almost every permutation of answers was seen. Reflection by the Earth's atmosphere is not well known.

## **SECTION C – MODULE P6**

### **Question 12**

- (a) This question was well answered. There is some confusion between the symbols for relay and variable resistor.
- (b) This question was not well answered. Fewer than half the candidates correctly stated that the resistance would increase.

### **Question 13**

- (a) Almost all candidates scored both marks, although a good number believe that kettles and toasters have motors inside them.
- (b) The magnetic field due to a wire is not well known. Two thirds of the candidates chose a field pattern similar to that of a bar magnet.

*Report on the Units taken in June 2009*

- (c) This question discriminated well at the higher grades. Many labelled the parts of the generator as motor or dynamo, others used words such as casing, paddle, iron core.

**Question 14**

- (a) This question discriminated very well at grade C. Weaker candidates thought that transformers work on indirect current.
- (b)
  - (i) Despite the necessary equations being provided, a significant number of candidates chose to use one of the equations of motion.
  - (ii) The use of transformers is not well known.

**Question 15**

- (a) The majority of candidates could choose the correct direction for the current through a diode.
- (b) There were few correct responses. Half-wave rectification is only understood by a small minority of the more able candidates.
- (c) Even fewer candidates could explain the use of a capacitor to store charge and smooth the output.

**Question 16**

- (a) Whilst the more able candidates answered in terms of 0/1 or high/low, others wrote positive/negative or A/B.
- (b) The truth table for a NOT gate is more widely known although again positive/negative or A/B featured in some answers.
- (c) Very few candidates could identify a device that a logic gate will operate.

## B652/02 Higher Tier

### General Comments:

This 60 mark paper had a mean of 38, gave a good range of marks and on balance offered appropriate challenge across the grade range. The highest mark scored was 60 and the lowest mark scored was 7. The whole paper was able to reliably discriminate across the ability range at grading. There was no evidence of candidates running out of time. There were also relatively few 'no responses' to questions.

The performance on calculation questions improved further this year with even weaker candidates getting many of them correct.

A substantial number of candidates seemed unable to string together a reasonable and sequential argument in some of the extended writing questions. A useful technique for some though was to adopt a 'bullet point' answering approach. These answers tended to 'attack' the question rather than waffle around it.

The paper covered a large range of items from P4, P5 and P6. The majority of candidates seemed to have covered most of the specification and attempted all the questions. Clearly the use of revision guides and past papers had helped candidates raise the standard. Unit P6, however seemed less secure in the minds of the candidates. This was most obviously so with weaker candidates.

### Comments on Individual Questions

#### SECTION A – MODULE P4

##### Question 1

- (a) (i) Many weaker candidates simply referred to 'friction' or 'rubbing' [0]. Better answers explained the transfer of electrons to the comb [1]. Other answers such as 'comb has an excess of electrons' also scored [1]. Some fell short in stating that it had electrons [0] which of course it had even before it was charged anyway.
- (ii) In explaining why the hair stands on end some thought it was 'attraction to the comb' [0]. Better answers stated that the like charges (on the hairs) repelled each other [1]. Only a third of candidates got this correct.
- (b) This part was better answered and understood. Most knew that the comb and paper were oppositely charged and would therefore attract [1]. There were also some good answers in terms of induced charge and polarisation [1].

##### Question 2

- (a) This was a 3 mark continuous writing question and was a common question with the foundation paper (grade D/C demand). It was well answered by the majority of candidates on this higher paper. Most got the idea of the dust being charged [1] and the plates being charged [1]. Better answers included the grid charging the dust and the oppositely charged plates [1] attracting it [1]. There were some vague answer such as the 'chimney' or 'precipitator' is charged [0]. Also some thought the plates had opposite charges.

- (b) Examiners were seeking to award a mark for the idea or description of earthing. About 2/3rds of candidates gained the mark. There were some good clear answers such as 'the worker completes the circuit to earth' [1]. 'Electrons run through the worker to (or from) earth' was also seen and awarded [1]. Other answers fell short of the required answer e.g. 'the shock goes through the body' [0], 'the charges go to the skin' [0].

### Question 3

- (a) This ohm's law calculation was done very well. Two marks were given for the correct answer 4 (ohms). On the rare occasions that this answer was incorrect then the candidates working was examined. If the correct substitution into the correct equation was evident (ie.  $6V/1.5A$ ), then this scored [1]. This is the general rule for most calculations.
- (b) Most knew that adding a cell increased the voltage [1].

### Question 4

- (a) This statement had not been asked before in this way. There were some answers in terms of 'high pressure area' or 'the particles are squashed together' which scored [1]. Also acceptable on this occasion was 'the waves are bunched up together in a compression' [1].
- (b) This short answer – 'complete from the list' type question was done very well. Most candidates scored 2 or 3 marks here. Common errors were to think the ultrasound wave was 'refracting' or 'diffracting' rather than **reflecting** from the baby.

### Question 5

In this three mark question the colliding particle was often given as a neutron [1]. Common mistakes were 'proton'. 'Nucleus' was usually correct for the second response. The 'atom splits' was seen less often [1] whereas decays, breaks up, blows up [0] were common attempts at this answer.

### Question 6

- (a) This was a challenging question which discriminated well at the grade A boundary. About 1/3<sup>rd</sup> of candidates were successful. Able candidates knew that with beta decay the mass number was unaffected at 207 [1] but its atomic number is raised by one to 82 [1].
- (b) This question on aging rocks proved too challenging for most. Whilst the correct answer was uranium and lead [1] given by only 1/6<sup>th</sup> of the candidature, many candidates guessed almost randomly. Any two elements or materials were given. Sodium and lithium, alpha and beta, carbon 14 and carbon 12 and other combinations too numerous to mention were seen. Other more reasoned guesses stated uranium but not lead [0]. Uranium and carbon were common.

## SECTION B – MODULE P5

### Question 7

- (a) and (b) Most candidates knew the speed increased when leaving the glass [1] and could draw the internally reflected ray [1] at a reasonable angle [1]. Common errors were to draw a refracted ray [0]. Three quarters of candidates answered all question 7 successfully.
- (c) This question was answered well in terms of gaining marks. Marks were available for differences in wavelength [1], speed [1] and refractive index [1]. Most answers gained 2 marks for these. Better answers wrote about red having longer wavelength [2] or higher speed [2] or lower refractive index [2].

### Question 8

- (a) Most candidates knew that a geostationary satellite takes 24 hours to orbit the Earth [1]. Often correct also was the idea that a closer satellite orbits in a shorter time [1]. 'Quicker' time was also awarded [1] and was often seen as an answer.
- (b) 'Centripetal' was the answer to this 'chose from a list' type question. 'Centrifugal' [0] was a tempting distracter for many as was 'orbital' [0].
- (c) Most knew that a 'stronger gravity' made the satellite orbit faster.

### Question 9

- (a) Clear answers stated that vector has magnitude (or size) and direction [1]. Some instead explained correctly in the context of speed and velocity.
- (b) Again in this part the calculations were answered well. Part (ii) was answered slightly less well but it was arguable a little more challenging.

### Question 10

This was a demanding extended writing question on momentum. It discriminated very well at higher grades. Many poorer answers wrote colloquially and missed the marking points. Good answers were along the lines of the momentum is conserved [1] before and after and because the cannon has a larger mass [1] it recoils with less speed [1]. Some were too vague about the speed with 'it goes back less'. Others were unclear about which (cannon or ball?) had the higher mass and lower recoil speed. Some answered in terms of reaction and equal and opposite forces idea [1]. If they went on to state that the momentum was conserved or zero they then had access to the additional marks.

### Question 11

- (a) Few knew that transverse waves can be polarised. The mark scheme was opened up to include UV, IR and **visible** light [1] as reasonable examples. 'Light' on its own was given in the question so was not worth a mark.

- (b) This question about polarisation proved difficult for many. It was challenging in terms of content but also communication skills too. Good answers referred to the waves vibrating in the same plane [1]. Sometimes the answer could be awarded from a correctly labelled diagram. Many just stated that the waves move in the same direction [0] rather than move side to side in the same direction [1]. Only a quarter of the candidature explained this correctly.

## SECTION C – MODULE P6

### Question 12

- (a) This voltage calculation was done well.
- (b) (i) Most could see from the graph that the resistance increased [1].
- (ii) They were asked to explain the shape of the graph. Most candidates got 2 marks but only the most able gained 3. Marks were available for increasing temperature [1] and resistance [1]. Also occasionally seen was 'non-ohmic' [1]. Better answers explained also in terms of atoms vibrating more [1] and electrons colliding more [1].

### Question 13

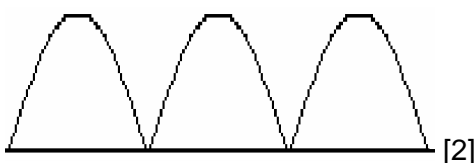
- (a) (i) Most correctly chose the circular field in part A. The common chosen distracter was B.
- (ii) Most chose downwards from the list [1].
- (b) More turns [1] and stronger magnets [1] were often given. Also acceptable was bringing magnets closer [1]. Incorrect answers were 'spin it faster', 'use more voltage' or 'use more current'.

### Question 14

This transformer calculation question was arguably more difficult than other calculations. It was more discriminatory than other calculations but it was answered well.

### Question 15

- (a) In this part candidates were asked to sketch the graph output from the bridge rectifier. More able candidates got both marks for rectification of three waves in line.



However some did not complete all three waves [1] and some simply copied the wave given in the question [0].

- (b)** Candidates were asked to explain how the bridge rectifier produced direct current. It was a challenging question for all candidates. About a quarter were successful in their attempts. The most common correct response was that the diodes only let current through one way [1]. Seen rather less often was the idea that the diodes work as opposite pairs [1]. Many answers restated the question or described a route through the circuit without hitting any of the marking points.
- (c)** Few referred to the idea of smoothing for the answer [1]. Marks were also awarded for meaningful diagrams.

**Question 16**

- (a)** The truth table was often done correctly [1].
- (b)** Candidates were asked to describe how the relay worked. Whilst many restated the question [0] usually 1 mark was awarded for getting one of the marking points. Good answers referred to 'the relay is operated by a small current' [1] 'to switch on a large current' [1]. Others referred correctly to the mechanical operation of the relay [1] or the isolation idea [1]. About a quarter of candidates scored 2 marks.

## B655 Report on Gateway Science Skills Assessment

### A General Comments

Although this is for some teachers and moderators the third year of this form of skills assessment, some centres are still making the mistakes common in the first two years. It is pleasing to report that there are many candidates who now produce good considerations of the topic in their Science in the News report, looking for and against and then using their research to come to a considered decision. Unfortunately there are still centres that seem to regard this aspect of the specification as irrelevant, consequently not preparing candidates with the necessary skills. Science in the News reports are then produced which do not embrace the importance of candidates researching arguments for and against. The reports are sometimes merely essays on the topic with scant regard for matching the Qualities.

For Science skills assessment, there are two components Can-Do tasks and Science in the News.

A total of 104087 candidates entered either for Science B625 or separate Biology(B635), Chemistry(B645) and Physics(B655).

The table summarises the number of candidates in each specification.

Specification	Subject	Number of candidates
B625	Science	81244
B635	Biology	9336
B645	Chemistry	6914
B655	Physics	6593

It is pleasing to report that there is an increase in the number of candidates doing separate Sciences.

It is possible that candidates use the same piece of Science in the News for more than one specification. However, each specification is moderated separately so if the same piece of work is used it must be photocopied each time it is used. Marks cannot be just transferred from one specification to another. Some centres continue to ignore this important point. Failure to do this makes the Moderator's job more difficult.

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



## **B 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. Despite the column on the form, dates for the Can-Do tasks are not essential. There were still some arithmetical errors in Can-Do tasks. 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 listed in the specification and on the Skills Assessment Record. They cannot devise their own. For a separate science, e.g. Chemistry, all the Can-Do tasks must be from the Chemistry list.

### **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. Some centres still use unapproved and unsuitable tasks. If they do not fully match the requirements of a task, candidate marks will suffer. If a centre has a good idea for a task, it must be approved by OCR in advance of its use (see Science Support Booklet p27).

A task set for P1, for example, cannot be used for Biology and a task from P5 or P6 cannot be used for Science. Centres still disregard this instruction. Although the task about mobile phones in P5 may seem suitable for P1 because mobile phones are mentioned in P1d, candidates will not have covered the additional theory in P5.

There were some problems where centres were attempting to double enter from Entry Level but this was less significant this year.

### **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 Science in the News reports are to be 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 background knowledge. The teacher must not give any opinion on the question for the task. However, they may read through the stimulus material and explain any scientific words.

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 is applicable for all tasks. There are still a few centres trying to use non-generic writing frames which provided too much help 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 for Quality A. 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 giving too much help.

## **Research time**

Each Topic requires the candidates to undertake some research for themselves in a period of approximately one week. This research could be carried out in school, either in the laboratory or a computer facility or it could be done at home. It is emphasised that the candidates do not need to be supervised during this preliminary research and they do not necessarily need to work on their own. If the preliminary research is done in school, teachers can provide a range of materials from which the candidates can select to get 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 thus removing the necessary element of choice and selection on the part of the candidate for relevant aspects. The best reports came where students had the freedom to investigate the question set selecting their own sources.

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

- a range of source materials used
- different processing to be done in Quality B, for example, not all candidates having the same bar chart
- candidates answering the question in different ways.

## **Supervised session**

The Science in the News report is written up under controlled conditions following the completion of the preliminary research. A time of 1 hour is suggested but the centre may extend or reduce the time if required. If more than one lesson is needed, the work must be collected in from the candidates at the end of the first lesson and stored securely until the second session. During the supervised session, candidates are required to work independently.

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

Candidates can bring into the supervised session charts/graphs that they have completed as well as a completed bibliography, thus reducing wasted time during the session. They may not bring in word processed or hand written reports.

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 supervised session in any 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 not be accessible 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 submitted.

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 is impossible.

Under no circumstances should any Science in the News tasks be drafted, marked and subsequently redrafted. What is produced at the end of the supervised writing session has to be submitted. If there are deficiencies, candidates should be told how to improve next time and

given another task to do. There was still clear evidence that drafting and redrafting, or teachers advising candidates to make additions, went on in a small minority of Centres. This is totally unacceptable.

Evidence of drafting and redrafting of candidates' reports or too much coaching will lead to the work not being accepted for moderation and being reported to the Malpractices committee.

## **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. These tasks ensure that practical Science is an important aspect of teaching for this specification. Some of the tasks 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. For a task to be credited it must be carried out as individual work. Groups of candidates cannot work collectively to complete 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.

From September 2008 there were some slight changes to the mark descriptors. The use of these new mark descriptors caused no problems this year.

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.

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

It is important that internal standardisation is carried out and the moderator informed of the way in which it has been done. 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. This 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 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.

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 each of the sources is fully referenced so that it can be checked. It is also essential that the source is clearly identified where it has been used in the report.

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 is awarded for the quality of the research and how it is used to produce a balanced report, rather than the quantity of research which has been carried out. 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 from their sources or the OCR stimulus material.

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...*'. The trends quoted must be correct. 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 stimulus material.

There are still many examples of candidates carrying out processing, even quite advanced processing, without identifying any trend. This cannot be awarded 2 marks as the mark descriptors are hierarchical.

## *Report on the Units taken in June 2009*

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. Processing could be drawing a graph, pie chart or bar chart from the data, calculating averages or percentages, or extracting and using data from a graph etc. All processing must be correct. A poorly drawn graph with incorrect scales or incorrect average calculations will not gain credit. Teachers are reminded that, for the sort of data obtained, bar charts are often more appropriate than line graphs.

Still 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, however, they did not fully understand what they were trying to do. This is an increasing and unwanted trend where teachers are giving far too much direction to candidates to undertake processing which they don't understand.

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 the Science in the News task. There are still some reports 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 reliability of different sources and explain why one source is likely to be more reliable than another. To award more than 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. Some centres did not develop these aspects sufficiently with their candidates during the teaching process.

Not all Science in the News tasks provide the same 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 an answer must be given. Most candidates now are giving an answer and a reason which allows the award of 2 marks.

To award 4 marks the candidate needs to show that they came to their answer using what they have found out. That is why it is essential to refer back to sources although full references are not needed.

For 6 marks a candidate needs to decide which source is more significant in helping them to come to their answer. Few candidates do this.

### **Quality F (Quality of written communication)**

Centres were quite good at 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 correct use of scientific vocabulary.

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

The assessment should be made of what the candidate has written and so a report which is largely pasted in from websites will not score well.

## **E Summary Comments**

The moderator does everything to support the decisions of centres. 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 always considered by at least two moderators. To summarise, if a centre is within plus or minus 4 marks no change is made but if the average is, for example 5 marks, 5 marks would have to be deducted.

Moderators are encouraged to provide useful reports for Centres. The moderation was accomplished efficiently and effectively. The team of moderators, team leaders and senior team leaders worked hard and efficiently to complete the process in the limited time available.

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 revised Science Support booklet (which is also available on Interchange).

Many Centres continue to use the free OCR Coursework Consultancy service. Each year a Centre can submit good quality photocopies of three marked Science in the News reports to OCR. They will then receive a written report from a senior moderator on the quality of the marking. This means centres can use this as part of their internal moderation and then enter candidates for moderation with some confidence.

## **F 2009 Grade Thresholds for B625**

The distribution of marks for Science in 2009 was very similar to the distribution of marks for 2008 with a small increase in the mean mark.

**Grade boundaries for 2009**

	Grade threshold							
	Max. mark	A*	<b>A</b>	B	<b>C</b>	D	E	<b>F</b>
Can-Do tasks and SinN	60	55	<b>51</b>	46	<b>42</b>	37	32	<b>27</b>

**Grade boundaries for 2008**

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

**Grade boundaries for 2007**

	Grade threshold							
	Max. mark	A*	<b>A</b>	B	<b>C</b>	D	E	<b>F</b>
Can-Do tasks and SinN	60	55	<b>50</b>	45	<b>40</b>	35	30	<b>25</b>

Marks in bold were determined by consideration of the Grade Descriptions listed in Appendix A of the Science Specification, and also by the quality of the work submitted when compared with the work from last year and with A 219 (21<sup>st</sup> Century Science Skills Assessment).

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 68% of the Biology candidates entered for B635 rather than B636, 57% of the Physics candidates entered for B655 rather than B656 and 55% of the Chemistry candidates entered for B645 rather than B646. A great deal of care was taken to ensure that performance by the two routes was comparable in each case.

**The grade thresholds have been decided on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards. Some adjustments may be expected as experience with the mark descriptors grows.**

# B656 Report on Gateway Additional Science Skills Assessment

## A General Comments

In this, the second year of this unit, the majority of centres coped well with the assessment tasks and applied the marking criteria accurately. There were however, some problems and a significant number of centres had to have their marks scaled, a few by a large amount. Other than over-generous marking, which is covered under the headings of the different components, the following caused problems in some centres.

- A mistaken choice of task. This occurred when a centre chose a task from modules 5 and 6 of a subject for use in Additional Science. These modules are not part of Additional Science and so this choice is forbidden. More seriously a few centres submitted a task for the wrong subject when entering for a separate science subject. This is the same as trying to use a result in a Biology examination to gain marks in Physics
- Lack of internal moderation. If one teacher marks more generously than the others, it can result in the work of the whole centre being scaled down even those candidates whose work was correctly marked
- Lack of annotation. Whilst annotation of students work is not compulsory, it is easier for a moderator to support a centres decision if the centre points out what the candidate has written which deserves that mark. This is particularly important if the decision is a borderline one.

## B Administration

The paper work from most centres was in order and created no problems. There were, however, some centres where things did not go smoothly. These were the things which caused problems on more than one occasion.

- A missing candidate record sheet meaning that the mark for Practical Skills was unclear
- Wrong addition of the marks for the three components, leading to a CW amend form being needed
- Different marks entered on the candidates work and on the MS1 form with the same result
- A copy of the MS1 form which was so faint as to be illegible
- A missing centre authentication form. The lack of this form can result in results being withheld.

These problems delay the process of moderation and communication with centres was sometimes very difficult with many requests being needed to acquire the correct paperwork. It is a good idea if centres include, with their sample an Email address which enables the person responsible for the assessment to be contacted.

## Supervision of Candidates

There is no need for close supervision for 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. Whilst examination conditions are not necessary the supervising teacher must be confident that the work is the candidates' own to enable the Centre Authentication form to be signed.



The work does not have to be completed in one hour and, if necessary, it can be completed over two sessions. If work is completed over two sessions then work should be collected in and reissued for the second session. The work should not be marked or assessed in any way between sessions nor should candidates be given any other assistance.

Redrafting of work is forbidden and inappropriate assistance can be considered malpractice.

## **C Research Studies**

It was good to see a wide range of Research Studies being used this year. Centres took advantage of the different studies available in each subject area.

The marking of these studies was usually reasonably accurate and nearly always within tolerance. Where there was generosity it was usually in the assessment of quality A.

This year the great majority of candidates produced their studies by answering the five questions separately. This is a more reliable way of ensuring that all the salient points are covered than answering the whole study in essay format.

### **Quality A: Collecting Information**

It is important to remember that the sources used by candidates must be referenced in or at the end of the Study. Even an excellent piece of work answering all the questions in great detail can only score a maximum of 2 marks for this quality if no sources are referenced.

Sometimes marks of 6 were given by centres which presumably knew that their candidates had accessed suitable sources. However, if there is no evidence there can be no credit.

This was the least accurately marked of the four qualities even though it is the easiest to get right.

If sources are given in full in a bibliography at the end, then 4 marks can be scored provided it is clear that they have been used. If it is indicated, within each question, where the information came from then 6 marks can be scored. If sources are only linked to questions not to the information given then 5 marks is appropriate.

### **Quality B: Interpreting Information**

The interpretation of the science involved in the study is key to this quality. Understanding is key to interpretation. It was noticeable, this year that many candidates were quoting from websites which effectively gave the answer to some of the more straightforward questions.

If the quote is directly relevant to the question, some understanding is implied and a mark of 4 would be a fair judgement. However, to gain a higher mark it must be clear that the student fully understands what they are writing. This would be demonstrated if the candidate were writing in their own words or if they added some relevant comment to a given quote from a website. It was sometimes the case that candidates were given marks of 5 or 6 for answers which were demonstrably copied directly from websites.

It should be noted that, where not all questions have been answered or where questions have only been partially answered, marks of 5 and 6 are unlikely to be appropriate.

### **Quality C: Developing and using Scientific Ideas**

Here we are looking for the ability of the candidate to go further than the requirements of the specification. It may be that some discussion of a current scientific debate is required or an explanation of a scientific idea at a greater depth than that required by the specification. Whatever is required, the response must fully answer the questions posed.

As above the student must demonstrate an understanding of the points being made. Quotes from or lists derived from sources are never worth the higher marks, scoring 4 at most. There was again a tendency in some centres to give high marks for quotes from websites which seemed to answer the question concerned but which didn't demonstrate the student's understanding of the points being made.

### **Quality D: Quality of Written Communication**

As last year centres usually marked this reasonably accurately.

Where adjustment to marks was necessary, it was usually because the teacher marking the work had mistakenly credited the student with marks for the English copied from a source. When this language was compared to the student's own English in different questions there was a clear mismatch.

Credit should only be given for the student's own use of English. Where the work is almost entirely copied from the internet and other sources it is difficult to justify a mark of more than 2.

## **D Data Tasks**

It was again good to see a wider range of Data Tasks used though not as wide a range as was the case with the Research Studies. The 'old favourites' such as Bouncing Balls still appeared regularly.

Where scaling was necessary it was usually because of over-marking of the Qualities assessed in the Data Task. In the case of large scalings this was almost universally the case. The Qualities which caused the greatest difficulties were Qualities B and C and to a lesser extent Quality E, though all Qualities were over-marked on occasion.

### **Quality A: Interpreting the Data**

The graph should be the easiest thing to score marks on. In the majority of cases it was but in some centres the marks given were too high.

The main areas where candidates lost marks were:

- not drawing a suitable 'best fit' line (or curve)
- drawing a graph which was too small
- drawing a graph with axes the wrong way round
- plotting points inaccurately
- joining a graph to the origin where inappropriate.

Marks lower than 4 were rare but centres are reminded that; a best fit straight line should have an equal number of points on each side unless anomalies are being excluded; a graph should occupy at least half of an A4 grid; the controlled variable should always be on the 'x' axis; points should be plotted accurately; and it is not always appropriate to draw a graph going through the origin (it is sometimes actually wrong).

There were cases where the raw data was not included with the work. This meant that plotting could not be checked and limited the mark available.

### **Quality B: Analysis of the Data**

Missing data was sometimes a problem with this skill too. The most usual 'processing' used to gain two marks is the averaging of three attempts at each value. If the data are not included then this mark can sometimes not be achieved. This means that, even with a complete description of the trends the maximum mark available is 3.

Marks of 4 were frequently gained in this skill but, equally, marks higher than 4 were often given without justification. Additional processing which leads nowhere should not be given credit, nor should the spotting of an anomaly where a point does not lie on a smooth curve.

The additional processing which is done needs to show something which is not immediately obvious from the raw data or it needs to show that what seems to be reliable data is in fact invalid in some way.

It was clear that some centres gave their candidates ideas as to what additional processing could be done. In most cases the candidates did not understand why they were doing it and made no use of the information which they could have obtained. They were, however, sometimes given credit for 'following instructions'.

This is a high order skill designed to discriminate between candidates of high ability. A candidate should see the opportunity for additional processing for themselves without assistance from the teacher. In good centres more able candidates succeeded in gaining 5 or 6 marks with no outside assistance.

### **Quality C: Evaluation of the Data**

There are two strands to this Quality, the data and the experimental procedure. The attention of centres is drawn to the title and the word DATA which appears in it. Analysis of the data obtained should be the main aim of the candidate. If the reliability of data is not addressed then the maximum mark achievable is 3, no matter how thorough the treatment of weaknesses in the method.

It is not sufficient to say 'we used the fall back data and that must be reliable because it was provided by OCR (it is not even accurate to say that, as unreliable results are always built in to the fall back data). It is equally not sufficient to say we used a computer simulation and computers do not make mistakes.

A more common error was to say that the data must be reliable because we did three repeats and doing five would make it more reliable. Repeats may make the average more reliable, they do not make the raw data more reliable. Many candidates stated that their data was reliable when more than one values was clearly divergent. It was often the case that marks of 5 or 6 given by the centre had to be reduced to 3 or even 2.

Reliability of data is most easily addressed by comparing the results gained in the three repeats required in most data tasks. Where only one value is taken, proximity to a best fit line is an alternative. The data themselves must be discussed to gain marks of above 3.

Validity must be discussed to gain marks higher than 4. To be valid, data must first be reliable. If the data is reliable but does not give an expected conclusion then it is not valid. For example, a best fit line may not go through the origin as expected or a value calculated from the data may not agree with a known value. If data is not valid it must be due either to the method/apparatus or to 'operator error'. This gives the candidate the opportunity to discuss the procedure part of the task.

### **Quality D: Justifying a Conclusion**

This was, in general, marked more accurately than the previous two Qualities though there were exceptions. A conclusion of sorts has been given in the form of the pattern described in Quality B. This quality involves justifying that conclusion.

Where candidates were marked too generously it was usually because they had written about the theory involved in the phenomenon observed but had not explicitly linked what they had written to the data which they had obtained. An examination of the criteria will reveal that, at each level, the word DATA is included. If neither the data themselves nor the pattern described in Quality B are referred to in this answer, then it is difficult to award high marks even if the science used is of high quality.

The problem seems to be that candidates learn the theory necessary before embarking on the Task and then regurgitate it (with greater or lesser accuracy) in answer to question 4. If it is correct, the centre awards it 6 marks even if no reference whatsoever is made to the data or to the pattern observed in the investigation.

To gain marks at the highest level in this skill it is necessary that the science used is correct, fully understood and explains the data obtained in the experiment completely.

### **Quality E: Planning further Work**

The plan must be sufficiently detailed to allow another person to carry out the intended experiment. In all cases it is possible to use the investigation already carried out as a basis for the plan. It is, then, often not necessary to describe all the apparatus needed. What must be included is:

- the variables which to keep constant and which to vary
- how to ensure that variables are kept constant
- the range of values to be used for the controlled variable.

Only if there is sufficient detail in the method given, can marks in excess of 3 be obtained. Marks higher than 4 are achieved by considering the importance of the new information which would be obtained. There is usually a question to lead candidates in the right direction.

Where this skill was generously marked it was either because the method proposed did not give sufficient detail of the variables and their control or because the method wouldn't work.

## **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.

Many 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.

The tasks used were, in the main, those from modules 3 and 4 of each science but it was pleasing to note that some of the tasks from modules 5 and 6 were beginning to be used.

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 Other Matters**

Centres are thanked for the diligent work which the vast majority put into the assessment of the work of their candidates. Where this is done moderators can support the decisions made by centres and the process runs smoothly.

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.gcse-science.com](http://www.gcse-science.com).

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

## **Grade Boundaries**

<b>Grade</b>	<b>A*</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>Mark/60</b>	<b>54</b>	<b>49</b>	<b>43</b>	<b>38</b>	<b>32</b>	<b>26</b>	<b>20</b>

# Grade Thresholds

General Certificate of Secondary Education  
Physics B (Specification Code J645)  
June 2009 Examination Series

## Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B651/01	Raw	60	-	-	-	37	31	25	20	15	0
	UMS	69	-	-	-	60	50	40	30	20	0
B651/02	Raw	60	43	36	29	22	16	13	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B652/01	Raw	60	-	-	-	31	26	22	18	14	0
	UMS	69	-	-	-	60	50	40	30	20	0
B652/02	Raw	60	45	37	30	23	17	14	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B655/01	Raw	60	55	51	46	42	37	32	27	22	0
	UMS	100	90	80	70	60	50	40	30	20	0
B656/01	Raw	60	54	49	43	38	32	26	20	14	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 2009. 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
<b>J645</b>	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
<b>J645</b>	20.7	50.7	77.1	93.5	98.3	99.4	99.8	99.9	100.0	11054

**11262 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](http://www.ocr.org.uk/learners/ums_results.html)

Statistics are correct at the time of publication.

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