GCSE

Physics B

Gateway Science Suite

General Certificate of Secondary Education **J265**

OCR Report to Centres June 2015

This report on the examination provides information on the performance of candidates, which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

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

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General Certificate of Secondary Education

Gateway Physics B (J265)

OCR REPORT TO CENTRES

B751/01 Unit 1 – Foundation Tier

General Comments:

This paper had a low entry of approximately 350 candidates. The majority of the entries came from centres that entered a single candidate. Very few centres had entries in double figures.

This paper had a maximum mark of 75 with a mean of 31.7 and a standard deviation of 9.4. The candidates' marks were in the range 8 to 57. All candidates entered for the appropriate tier.

The paper was of appropriate length with no evidence of candidates running out of time or having time to spare.

The main obstacle to candidates achieving higher marks was that they failed to read the questions fully and so did not complete the question correctly. This was particularly noticeable in the 6 mark questions but other examples include being asked to pick two correct answers with only one being chosen.

Again this year many candidates continued answers on extra booklets. Much of this appeared unnecessary, with candidates writing single words or short phrases that would easily fit into the answer space or the space directly below the question. Copying out the question wasted a large amount of space on the answer lines.

Comments on Individual Questions:

Section A

Question 1

1(a) Most candidates realised that the correct graph was A, but failed to give the correct explanation that it had the most water. The answer needed to be comparative. Several candidates gave the answer that it contained 40g of water, which was not credited as it was in the question.

1(b) (i) The majority of candidates correctly answered W.

(ii) The majority of candidates correctly answered Z, X being the most common incorrect answer.

(iii) This question provided a few good answers from candidates who realised that the specific heat capacity of ice is less than that of water. Examiners were after a simple answer of ice warms faster than water.

(iv) There was much confusion between specific heat capacity and the two different specific latent heats, with few candidates being able to explain the difference in time between Z and X.

Question 2

2(a) Candidates were asked to explain why one wall lost less heat than the other wall. The question asked candidates to use ideas about conduction, convection and radiation, but very few candidates mentioned convection and, therefore, excluded themselves from the level 3 marks. This was targeted at level C and was a common question with the higher paper.

Candidates could have gained full marks by a simple statement about each wall and the method of heat transfer eg air is a good insulator; trapped air reduces convection; shiny foil reflects IR back into the house; and wall B is thicker than wall A so less conduction.

2(b) The first part of this question performed well with the majority of candidates making a relevant comparison of the costs. The second part proved more difficult for the majority of candidates. The examiners were looking for candidates to think of reasons as to why the heating bills were higher than expected. These include: increases in the cost of energy; **extra** appliances being used; cold weather requiring more heating; heat loss by leaving windows open etc.

Question 3

3(a) The majority of candidates correctly identified microwaves as the first type of wave used by mobile phones. The most popular wrong answer was gamma.

(b) (i) Candidates often gave general comments such as ‘harms the person’ or ‘causes cancer’. Examiners were looking for specific ideas linked to the brain. For example, ‘microwaves cause heating and may cause brain cancer’..

(iii) Few candidates said that the studies were inconclusive.

Question 4

4(a) Most candidates attempted this question, but a common misunderstanding was that the sensor detected movement and many thought that it sent out a beam of infra-red radiation which was reflected by the object.

Those candidates who understood the working of these detectors found the question straight-forward. Examiners were looking for the idea that Ricco’s body emitted IR and the detector sensed this radiation.

(b) (i) Most candidates explained that the ball did not emit IR, or that the ball was too small to be detected. Both were acceptable answers.

(ii) In general candidates understood that aluminium foil reflected IR or prevented it from reaching the detector.

Section B

Question 5

5(a) Most candidates were able to name two fossil fuels used in power stations, although a significant number of candidates thought that petrol was used in power stations.

(b) Very few candidates correctly named a renewable fuel used in power stations. The majority gave renewable energy sources such as wind and solar.

(c) Almost half the candidates knew that the system of power lines is called the National Grid but the majority knew that it connected to consumers such as homes or factories. Examiners credited any correct consumer building.

(d) (i) This question was not answered well by many candidates. Examiners were looking for the idea, energy in = energy out, and that the wasted energy was usually heat.

(ii) The majority of candidates performed the calculation correctly, but a significant number of candidates were penalised 1 mark for putting % after 0.35 or missing % after 35.

Question 6

Candidates generally knew that nuclear radiation was used to treat cancer and that it could also cause cancer. A common mistake was that candidates thought that nuclear radiation was used to generate electricity – confusing it with the nuclear fuel used in some power stations.

Question 7

7(a) Few candidates were able to explain the greenhouse effect in anything but the simplest terms of the earth increasing in temperature. Examiners were looking for an explanation in terms of infra-red (or heat) radiation passing through the atmosphere and becoming trapped. Candidates were asked to suggest a cause. Some indication of increase was needed in the answer to score marks; for example, greater use of fossil fuels. A common mistake was to confuse this with changes in the ozone layer.

(b) (i) Breathing was the most common answer given for a natural source of carbon dioxide.

(ii) This was a common question and proved difficult for foundation candidates. A significant number of candidates did not make an attempt at an answer. Acceptable answers involved the idea that it had happened in the past.

Question 8

This question was a calculation on paying for electricity. The majority of candidates correctly calculated the cost of using the immersion heater (£7.20) and the cost of using the cooker (£2.40), but failed to finish the explanation with either a statement that the difference in cost is £4.80, which is nearly £5 so Habib is correct, or proving Alice is wrong 2x£2.40 =£4.80 which is not equal to the cost of using an immersion heater.

Question 9

This was a 6-mark question targeted at up to grade C.

The question asked about 4 things: passive solar heating, photo cells, how to maximise the energy collected and how this helps the environment.

The majority of candidates made relevant statements about using photo cells and several explained that the output could be maximised by putting them on the south side of a building and increasing the area. A few candidates added that there would be reduced use of fossil fuels at power stations. It was rare to see any comment about passive solar heating.

Section C

Question 10

This question was about speed.

(a) Candidates were asked to explain how average speed cameras work. The majority of candidates explained how ordinary speed cameras work. The candidates were able to score marks because they were credited with statements such as ‘two photos taken’ and speed = distance travelled/time taken. Centres should ensure that candidates understand the difference between a momentary speed cameral and an average speed one.

(b) The majority of candidates correctly calculated speed of the car.

Question 11

This question was answered well by the majority of candidates.

(a) (i) Candidates correctly identified B as the part of the graph showing an increase in speed.

(ii) Candidates correctly identified C as the part of the graph showing constant speed.

(b) Candidates correctly calculated the work done as 17600J.

(c) About 90% of candidates gave correct answers as to the benefits and risks of using seat belts.

Question 12

This was a six-mark question about a roller-coaster.

A common mistake by candidates was to think that the graph showed a height distance graph. Examiners had taken care in setting the question to emphasize speed in the first sentence of the question.

Weaker candidates managed level 1 by showing that kinetic energy depended on speed. The better candidates were able to calculate KE at B correctly and gained level 2. Only a few candidates answered the question in full by describing the change in KE throughout the full journey and calculating the KE at B.

Question 13

This was a data question about different cars.

(a) Candidates made some good conclusions from the data, such as 'the cost per km does not depend upon the distance travelled'. However, they often failed to give the full story, for example stating the further you go the less it costs, totally ignoring the 120km/hr speed. Examiners did not credit diesel is cheaper than petrol which is not true.

(b) This question was answered well by the majority of candidates who realised that tiredness would increase the thinking distance and that slippery conditions would increase the braking distance.

Question 14

This question was on alternative fuels for cars.

(a) (i) The majority of candidates correctly gave solar and electricity as alternatives to fossil fuels.

(ii) The most common one not thought to be suitable was solar with a reason that we do not get much sun in the UK.

(b) The majority of candidates correctly identified A as the situation with the best fuel consumption.

B751/02 Unit 1 – Higher Tier

General Comments:

This 75 mark higher paper gave a good range of marks from 0 to 73 and a healthy mean mark of 39. This was less than one mark lower than that in June 2014 (40). The answers showed that candidates generally were well-prepared and appropriately entered for this tier.

The paper was of appropriate length and there were very few examples of candidates running out of time. This, when it occurred seemed to be those candidates who used additional sheets. Although a few candidates left some answers blank, these ‘no responses’ tended again to be scattered throughout the paper rather than concentrated at the end. This year, however it was clear that there were more attempted answers.

It was evident that there was largely a full participation in the paper this time and candidates were showing more success on tackling the six mark questions than last year. In June 2014 it was evident that candidates were still coming to grips with some of the new approaches to questioning. For example, the developed calculations, How Science Works and data handling. In all these areas candidates tackled the questions better than in the past. The increasingly problem-solving approach to questioning generally tends to make questions more demanding and this again has made this paper a little more challenging than others. Most candidates coped well with this but were still able to demonstrate what they knew and confidently applied this knowledge to the various contexts. Some answers though illustrated misconceptions of some Physics ideas and these are highlighted in the next section, which covers individual questions.

Again this year there was an abundance of candidates continuing answers on extra booklets. Much of this appeared unnecessary, with candidates repeating the question in their answers, writing at great length on ideas that were not asked for in the question and generally failing to answer in a succinct manner. However more candidates showed more composure and direction in answering longer prose questions (6 markers). It was evident than many candidates had highlighted the key points in the question beforehand. These answers tended to be more focussed and structured thus hitting more of the marking criteria.

The How Science Works questions were nearly always attempted but some candidates were again often unsure how to tackle the questions. Generally though, these questions were done better again this year.

Comments on Individual Questions:

Question No.

1. The first question on section A module P1 was about heating in the home. The double-glazing advert worked well in that it got candidates into the paper and answering freely with a range of marks being awarded. Most could make a judgement about the energy costs and gained a mark here. Some went on and processed the data further to gain a second mark. Most however attempted an explanation but unfortunately many of these explanations were preoccupied with double glazing and payback cost as a reason for 2012/13 being higher. Some wrote about different weather but were not specific enough to get the mark. Better answer referred to colder winters or windows left open so the heating would have to be used more. About a third of candidates gained two or more marks here.

2. This question about energy transfer in the kitchen offered the candidates an opportunity to show what they knew of particles and cooking with waves. It produces a wide range of marks and discriminated well. Most candidates gained 4 or more marks overall.

a. In part (i), the conduction through the aluminium pan saw few answers refer to electrons in their answers. Many more however attempted particulate answers even if it was to say that the particles vibrated or started to vibrate. Better answers clearly stated that the particles vibrated more or had more KE. Rather more candidates however were clearly able to describe conduction as vibrations being passed on through the pan. This was a noted improvement on previous years.

In part (ii) about convection the candidates were invited to do a simple two-line rewrite of the incorrect description given in the question. Many answers were much more detailed however and often went off on a tangent. So what should have been a simple rearrangement of the sentences had some candidates writing paragraphs bearing little resemblance to the original sentences. Quite a few described the misconception that the particles themselves expanded.

b. This question asked about the differences and similarities about microwave and infrared cooking. Most knew that microwaves penetrated the food or just heated water [1]. Better answers referred to the microwaves giving more KE to the water particles. Answers in terms of IR heating (all) particles on the surface giving them more KE were also acceptable.

In part (ii), the similarities were based around the rest of the food being heated by conduction or convection and the KE being passed on between particles. Other acceptable similarities were less often seen but covered by the mark scheme. For example both waves are from the electromagnetic spectrum [1].

3. This six-mark level of response question on lasers and CD's was quite well answered. Many at least attempted to describe the laser light. Some were concise in describing it as coherent. Others gave much more detail in terms of same frequency and in phase. Often though one of these characteristics was missing from their answer. The storage of the information was better understood and described as was also the reflection of the laser beam from the pits and lands on the CD. It discriminated well across the six marks with the majority giving level 2 answers scoring three or four marks.

4. This question was about p and s waves and it was better answered than equivalent questions in the past.

a. Most knew that p (or primary) waves were received first due to their higher speed.

b. In tracing earthquakes many referred to the idea of using the wave directions to predict the source. Some referred to measuring the times and a few to the idea of triangulating the results.

c. There were some good answers here that described the waves as being unable to get through the liquid outer core. This idea was better answered than in past papers.

d. In part (i) a few used the correct wavelength (0.8m) to calculate the speed [2]. Rather more used two wavelengths (1.6m) to calculate the speed as 1.92 [1]. This distinction discriminated well.

In part (ii) a popular incorrect response for the amplitude was 0.22 although about 40% halved this value correctly [1] in their answers.

5. This first question on section B module P2 was about the Greenhouse Effect.

a. There were some common misconceptions here. Many thought that the waves simply reflect from the Earth rather than undergo absorption and emission. Some also thought that it is gasses rather than radiation that gets reflected or trapped. However there were good answers that referred to the (short wave) radiation penetrating the atmosphere or heating the earth [1]. Longer wavelength radiation being emitted [1] and this being absorbed or reflected back by the atmosphere.

b. In part (i), the table was completed well by most and it was common to see full marks here. A minority though did put photosynthesis for the natural cause of carbon dioxide.

In part (ii), many referred to ice ages [1] although some failed to emphasise the distant past in their answers so fell short of gaining a mark.

In part (iii), most used the table to highlight the unpredictability or reduced longevity of water vapour [1]. 'Only lasts a few days' was a common acceptable answer [1].

6. This six-mark level of response question on a radioactivity experiment was well answered and accessed by the great majority. Most answers were lengthy and often detailed. About a third of answers did not identify the sources correctly often getting gamma (X) and beta (Z) the wrong way round. Some became confused over the raw numbers – 'highest counts per minute means gamma', for example. The answers however discriminated well and gave a wide range of marks. About a third of candidates gave good answers and used the data logically to clearly explain their choice and get full marks.

7. This six mark question was about nuclear power.

a. As in previous years there is still some confusion about nuclear power stations routinely giving off radiation all of the time to the surroundings. When talking about waste they are not being specific that it is radioactive – a lot references to 'toxic waste' was evident. Good answers either concentrated on 'radioactive waste is radioactive for a very long time' or 'in the event of an accident radiation could escape causing mutations in people'. Some answers covered both ideas.

b. Answers to part b) often refer to the power station rather than to the rescue workers. There were good suggestions though in terms of monitoring with radiation badges, reducing time exposure and more commonly radiation-proof clothing or gas masks. There were frequent suggestions involving evacuation but of course that was given in the question.

c. This discriminated well with most describing the use of detectors [1] and rather fewer clearly describing when would be a safe return, for example, when levels return to background levels. Some thought that they would have to wait until there is no radiation at all.

8. This question on paying for electricity was answered well.

a. Most could workout the £2:40 [1] and £7:20 [1]. Better answers went on to calculate £4:80 (rather than £5) more and Habib as the choice of who is correct.

b. This calculation involving indices was done well (better than previous papers) and it was common to see also the explanation correct with references to lower current. Almost a third gained full marks.

9. The first question on section C module P1 was about speed and has 10 marks in total.

a. Perhaps pre-conceived ideas tempted some to assume that the Jaguar was the fastest. About 40% said Jaguar and 60% the correct answer of Golf. It discriminated well for a one-mark question. Also rather more candidates thought that the times of 8s then 9s indicated an increase in speed rather than a decrease. This misconception was also evident in part (ii) where the speed was usually calculated correctly [1] by most with the Golf, Fiat and Jaguar incorrectly accused of speeding by many. The lowly but guilty Skoda often escaped identification and candidates gave away a mark as a result. This two-mark question also discriminated well.

b. This question on stopping distances was answered well with most gaining the 2 marks.

c. There were some excellent responses about biofuels, which covered all marking points showing a secure understanding of the issues and processes. One common misconception though with weaker answers was that ‘biofuels do not produce CO_2 when burned’. Concise answers such a ‘plants take in CO_2 when growing and give out CO_2 when burned shows that they are carbon neutral’ where quite common.

d. Some thought that ABS brakes just activated automatically without any driver input to stop the car in an emergency. Another misconception was that ABS brakes actually locked the wheels rather than the opposite. Better answers referred to the brakes being quickly (and automatically) pumped on and off to avoid skidding or loss of control.

10. This question was set in the context of diving into water from a diving board.

a. Most answers showed the over-simplistic idea of distance = speed x time. So 19.6 gained one mark. Better candidates realising that the speed changed either worked out the area under the graph or used a calculation to get the correct answer of 9.8 [2]. Less than 20% gained both marks here showing that this calculation discriminated effectively at the highest grades.

b. In part (i), there were a few good answers described in terms of Elaine and these discriminated well. Usually the idea of more data or gradient showing the real or more accurate deceleration gave candidates a route into successful answers. It was a challenging question, which gave a good range of responses.

In part (ii), most gave 1200N as the correctly calculated answer.

11. This six-mark level of response question proved to be the most challenging of the three on the paper. It did involve a data-handling element to the question. The graph, for many looked like a roller coaster track, so about a third of students described the motion along this track. A sizeable minority scored low marks for having the whole thing the wrong way round. Many thought that A to B was climbing and B to C was falling. The more able calculated the height correctly. Again this question discriminated well at the higher grades with approximately 10% scoring five or six marks. About 10% also failed to attempt this question at all.

12. This question about powering cars was a good discriminator.

a. In this part candidates were asked to make conclusions about the data about petrol and diesel cars. Some were vague in their answers and they could not be matched to marking points with sufficient confidence. So ‘diesel is cheaper’ or ‘diesel cars are cheaper’ were insufficient and failed to refer to the fuel used. Using diesel is cheaper than petrol [1] was a common way of expressing the answer. Some referred correctly to the influence of speed and fewer still referred to the effect of distance.

b. In this part most correct answers were expressed in terms of the inconvenience of charging. So ‘charging takes a long time’, ‘frequent charging needed’ or ‘there are few charging points’ covered most correct answers. Other ideas about battery cars having a low top speed, short range (between charging) or being too quiet for pedestrians to hear were also occasionally seen and rewarded accordingly.

B752/01 Unit 1 Foundation

General Comments:

This 85-mark foundation paper gave a good range of marks (9 to 66) and a lower mean (34) than June 2014. As in 2014 the answers showed that candidates generally were well-prepared and appropriately entered for this tier. A very small number of candidates would have been better suited to the higher paper as they showed a well developed understanding of all areas assessed in the foundation paper.

The paper was of appropriate length and there were very few examples of candidates running out of time. Although a few candidates left some answers blank, these ‘no responses’ tended to be scattered throughout the paper rather than concentrated at the end.

There was some evidence that some areas of the specification had been covered less well by many candidates, most notably two source interference of sound, action of lenses, application of electromagnetic wave to communications, the behaviour of transistors, and rectification and smoothing. The challenge presented by these less familiar areas was the significant reason in the depression of the mean mark this year.

As in 2014 it was good to see candidates attempt calculations throughout the whole paper and in general there was an improvement in answers involving calculations. The interpretation of evidence presented as graphs was done particularly well in a variety of contexts.

The six-mark questions on longitudinal waves and logic circuits were very accessible to the whole ability range. The six-mark question on two source interference in sound was very challenging for nearly all candidates with the vast majority seemingly having little familiarity with this area of the Specification

The 10-mark data section at the end of this paper was in a context new to candidates. Most candidates achieved very well in this section and were able to interpret and process data accurately. It was pleasing to see that this section was accessible to the full range of candidates.

Comments on Individual Questions:

Question No 1.

This question exploring the relationship between current, resistance and length of resistance wire was challenging for many candidates.

ai. and aii   Most scored at least one mark recognising that the lowest current will arise when the resistance of a wire is highest or the length of the resistance wire is longest. Very few correctly linked the lower current, higher resistance and longer length to score two marks.

b.   This was a new diagrammatic representation of how a variable resistor works. Around a quarter of candidates did not attempt this question and only better candidates could apply knowledge to locate the contact to create the shortest length.

c.   In this three-mark question calculating resistance nearly all could score at least one mark by using he appropriate equation. However many candidates could not express in two significant figures with a large number choosing to round down from 4.67 to 4.7. In recent years the unit of resistance has been provided to students and it was surprising that few knew the unit of resistance as the ohm.

Question No 2.

This six-mark level of response question on Sound and Ultrasound was targeted at grades up to C. It was accessible to the full range of candidates. Candidates were asked to identify errors in the description and uses of sound and ultrasound waves. They were also asked to describe and explain the errors in a diagrammatic representation of sound. Most correctly identified the incorrect labelling of compression and rarefaction in the diagram and how this was corrected. Very few identified errors related to the continuous variation on pressure in a sound wave. In the table the responses on the whole showed a much less secure grasp of sound and many candidates incorrectly corrected sound waves to be transverse waves.

Question No 3.

This question was about absolute and relative dating methods.

a Only higher ability candidates coped well with interpreting and applying the information provided to explain why both absolute and relative methods are used together.

b. Less than half knew that the uranium/**lead** ratio was used in radioactive dating of rocks.

Question No 4.

This question on nuclear decay was quite well-answered across the full range of candidates. Most scored at least two out of four marks.

a. Nearly all could describe the trend in the data table correctly.

b This question on comparing the half life of samples from the decay over time was one of the most challenging on the paper. Very few could correctly use the data to explain which sample had the shortest half life-most candidates simply focussing on the lowest activity at the end of the time interval.

bi. This discriminated very well. Better candidates understood the dangers of using medical tracers with a longer half-life and often made a good link to cell damage.

c Around a third of candidates selected that radiation came from the nucleus. The most common wrong answer was selecting that it came from 'electrons orbiting the nucleus'.

Question No 5.

This question on electrostatics and the effect of moisture was accessible to most candidates.

a. This context about charging while walking across a nylon carpet is familiar. Many scored one mark for the idea of friction leading to charging but as in 2014 the explanation of electron movement and most candidates poorly described earthing.

bi. Most scored one mark for the simple relationship shown in the graph but very few achieved two marks and were not able to describe how the rate of charging with distance reduced.

bii Most could correctly use the graph to compare charging on days with differing levels of humidity [1].

ciii. It was very pleasing that nearly all candidates could interpolate the data to sketch the line for an intermediate level of humidity.

Question No 6.

This question about refraction was accessible to most candidates. In general candidates showed an understanding of refraction and internal reflection but struggled more to describe and apply refraction to the behaviour of a convex lens.

a. Most scored [2] usually for knowing the order of the spectrum produced by the dispersion through a prism.

b. It was surprising that less than half could describe a use correctly of total internal reflection. This year the most common answer was usage in super-fast communications with far fewer references to endoscopes than in previous years.

ci. Only higher scoring candidates regularly recalled convex as the name of a converging lens. A significant number did not attempt this question.

cii. Most candidates accurately completed the ray diagram.

d. As in 2014 very few could describe the type and location of the image formed by a convex lens. Around a quarter of all candidates did not attempt this question.

e. Almost all candidates attempted this question but the vast majority could not correctly sequence focal length of convex lenses by linking with lens thickness.

Question No 7.

This question on electromagnetic waves used for communications was not answered well. Candidates were unfamiliar with how different waves were reflected or scattered by the ionosphere and atmosphere.

a. Many achieved a mark for making a correct choice but few went on to achieve two marks for the explanation. The most frequent explanation worthy of credit was that that the wave had the longest wavelength.

b. Very few scored well on this question on absorption and scattering. In some part this was clearly down to a failure to understand the difference in magnitude between MHz and GHz.

Question No 8.

This question on satellites involved a developed calculation.

a. Most candidates were not able to work out the average speed when given the final speed of an object accelerating steadily from rest. Most scored one mark for calculating the distance travelled by multiplying average speed by the time in minutes and higher ability candidates scored two marks for doing the same calculation but correctly converting the time taken to seconds.

b. It was pleasing that most scored well on this question on the nature of peer review in scientific research.

Question No 9.

This six-mark level of response question on two source interference of sound waves was targeted at grade C. In general the quality of response across the whole range was very poor. It was clear that few candidates had undertaken or had demonstrated the practical investigation into interference effects of sound waves. When they had experienced the investigation candidates could provide a detailed description of both the set up and the simple effects of interference. Better candidates could explain how wave superpositioning (often with diagrams) created the interference effects.

Question No 10

This six-mark level of response question on sensing and logic gates was targeted at grade C. This question gave a good range of marks and discriminated well across the candidature. Most could either partially complete the truth table or name the two logic gates. Better candidates accurately completed the whole truth table and named the gates. Few candidates could describe accurately the three input conditions for specified outputs even when the truth table had been fully completed correctly.

Question No 11

This question on transformers was quite challenging across the full ability range.

a. Fewer than a quarter of the total candidature could recognise the circuit symbol of a transformer.

b. Most achieved at least one mark for knowing that transformers work with AC or that phone charges had strep down transformers. Most did not know about the use of isolating transformers in a shaver socket and so very few scored two marks.

c Very few candidates could explain why transformers improve electricity transfer. Frequently answers lacked clarity and made the most vague references to increased safety (and on many occasions preventing appliances from blowing up).

Question No 12

This context of transistors seemed unfamiliar to most candidates although many candidates accessed parts of the question very well by applying skills to use and interpret data supplied for different transistors.

a. This question was answered well.

bi. Most identified a general relationship between the base current and collector current.

bii The action of a transistor and the role of the base and collector was not known or understood by almost all candidates.

c Most scored at least one mark for the familiar context of advantages and disadvantages of miniaturisation.

Question No 13.

This question on ac generators was a familiar context for many candidates and discriminated well across the ability range.

a. The vast majority could match the labels to the parts of an ac generator.

b. Only higher ability candidates could describe the movement of the magnets as a way to generate electricity. In part this may have been due to them trying to look at how it could be done with the generator shown in the diagram rather than another generator as this has been a focus in previous years.

c. This part-question discriminated particularly well across the ability range. A significant number struggled to communicate the comparison of the two features for the two supplies and hence did not gain credit.

Question No 14.

This question on diodes and smoothing was not answered well or understood.

a. Many higher ability candidates used voltage-time graphs to identify circuits that contain diodes. Across the whole range only a very small number could correctly describe full wave and half wave rectification.

b. Across the whole ability range very few could show the smoothing effect of a capacitor to the full wave rectified output. This area seemed to be little known with most sketch graphs simply showing an increase in voltage over time.

Question No 15.

This data question on noise levels was answered well across the full range of candidates.

ai. Almost all selected the correct animal.

aii. Almost all selected the correct animal.

aiii. Almost all selected the correct animal.

bi. Almost all scored at least one mark and many scored two for selection of the person with the largest range, frequently supported by appropriate calculation.

bii. Most scored at least one mark for the attempt to calculate the mean from the data. Almost all higher ability candidates scored two marks. The most frequent reason for not scoring the full two marks was incorrect completion of the final calculation of the mean.

biii. This was less well-answered across the full range. Most frequently candidates recognised that disability and age were the most significant reasons for inconsistency in the data. Very few candidates made reference to the very small sample size or inaccuracy in making measurements.

B752/02 Unit 2 Higher

General Comments:

This 85 mark higher paper gave a good range of marks (0 to 81) and a lower mean (41.4) than June 2014 (45.4). The answers showed that candidates generally were well-prepared and appropriately entered for this tier. As always though, a few candidates would have been better suited to the foundation paper as they had very limited access to these challenging questions. The paper was of appropriate length and there were very few examples of candidates running out of time. Although a few candidates left some answers blank, these ‘no responses’ tended to be scattered throughout the paper rather than concentrated at the end.

It was evident that there was largely a full participation in the paper this time and candidates were showing more success on tackling the six-mark questions than last year. In June 2014 it was evident that candidates were still coming to grips with some of the new approaches to questioning. For example, the developed calculations, How Science Works and data handling. In all these areas candidates tackled the questions better than in the past. The increasingly problem-solving approach to questioning generally tends to make questions more demanding and this again has made this paper a little more challenging than others. Most candidates coped well with this but were still able to demonstrate what they know and can confidently apply to contexts. Some answers though illustrated misconceptions of some Physics ideas and these are highlighted in the next section where individual questions are covered.

More candidates showed more composure and direction in answering longer prose questions It was evident than many candidates had highlighted the key points in the question beforehand. These answers tended to be more focussed and structured thus hitting more of the marking criteria.

The How Science Works questions were nearly always attempted but some candidates were again often unsure how to tackle the questions. Often long-winded answers gained credit only in the last few words. Some of these questions were answered confidently and concisely using some of the language from the learning outcomes in the AO section in the specification. Generally though, these types of question again showed improved performance on last year.

The ten-mark data section at the end of this paper was in a context new to candidates giving a total of 85 marks. Most candidates carried their standards forward into this section and coped with the maths, data and written answers well.

Comments on Individual Questions:

Question No.

1. This opening question to Section A module P4 was about resistance and was well answered with most candidates gaining three or more of the five marks.

a. This voltage calculation in part (i) using Ohm’s law was answered correctly by most candidates who gave 0.72V [2]. Some answers did not attempt to give the answer to two significant figures. So it was common to see for one mark 0.7185 or 0.718 or 0.719 as the final answer. In part (ii) variable resistor ‘D’ was usually chosen.

b. Most knew that the length was related to the resistance and therefore the current. Rather fewer could apply this in the context of the diagram and describe it clearly. Some also got the relationship the wrong way round. For example, more resistance wire gives a larger current.

2. This was a six-mark level of response question to do with ultrasound scans. It was targeted at a range of grades up to A* and it discriminated well showing the full range of marks. The question asked candidates to compare its use for measuring body fat with using surgery or X-rays. There was also an ultrasound graph to prompt answers. The three areas for marking were discussing ultrasound versus X-rays, ultrasound versus surgery and the display itself. Many answers failed to mention surgery at all and a significant number did not refer clearly enough (or at all) to the graph and what it showed. Ultrasound versus X-rays was well covered by most with references to its inability to detect soft tissues or its ability to ionise cells or increase the risk of cancer. Regarding the display weaker candidates thought that each peak was a fat layer. Surgery as hinted at already was often omitted when a simple statement such as it can cause scars or a greater risk of infection would have got many answers a higher level of marks.

3. In part a) candidates usually gained one of the two marks available for the use of relative and absolute dating. Correct answers for b) were less common and it was clear that only about half the candidature knew that lead (and uranium) could be used to date rocks.

4. This question was about radioactivity and its applications.

a. This objective question produced a range of answers with 'electron' or 'fast moving protons' being commonly seen wrong answers.

b. Despite being instructed to tick two boxes, a large number only indicated one choice. About a quarter of candidates, however, got this correct.

c. Part (i) was about alpha decay and this was better answered than in previous years with just over half of candidates gaining full marks.

In part (ii) the question on the smoke detector separated the grades clearly. Most candidates scored the 'smoke blocking alpha' mark but only the better answers referred to the ionisation of the air. References to current were usually not clear enough to be creditworthy.

5. This question on electrostatics was answered more confidently than in previous years.

a. There were some (but fewer) references to 'positive electrons' [1] this year. Most answers clearly stated the movement of electrons from the carpet to Patrick [2].

b. This question asked candidates to interpret and make conclusions from a graph of electrostatic voltage. Some answers failed to mention distance at all. Most though described the voltage increasing with distance [1] with rather fewer describing the reduced build up at higher distances or voltage. Also included were many part a) type answers talking about friction or transfer of electrons.

In part (ii) some candidates gave insufficient or incorrect detail to score. Some simply described the difference in the pattern to day 1 – eg 'it's a lower voltage'. The concept of 'wet' was rare with the majority of responses correctly explaining it in terms of 'less friction' or wearing less insulating shoes.

6. In the first question to Section B module P5 the context was satellites.

a. This was a complex calculation involving a change of units. It discriminated well with high-grade candidates (about a fifth) giving 7 [3] as the answer. Two marks were awarded for 420 (failed to cover to minutes) or 3.5 minutes or 210s [1].

b. Part (i) was an intentionally challenging question, which required both confidence in the physics and some skill in its communication. Few referred correctly in terms of the forces. The idea that lower speeds would cause the satellite to spiral to Earth was reasonably common. Less common was the idea that at higher speeds the satellites would spiral into space.

In part (ii) the calculation of deceleration was also challenging but it discriminated well with about a quarter gaining full marks.

c. This ‘How Science works’ question on scientists on the satellite was well answered with most candidates scoring full marks over both parts.

7. This question was about communicating with electromagnetic waves.

a. The suggestions for improving microwave dishes were often correct. The explanations given were usually relevant if not entirely correct. One misconception was that placing the satellite dishes high on hills [1] would improve things as they are closer to space.

b. This question relied on the analysis of data from a table. In part (i), most chose ‘B’ with the correct reason. In part (ii), the correct answer ‘C’ was less common and of those correct answers the explanation proved more elusive.

8. This six-mark level of response question on dispersion was intentionally challenging assessing over a grade range up to A*. It discriminated well. There were very few good complete answers with references to refractive index usually omitted. There were many good answers that scored five marks in term of frequency or wavelength. Common misconceptions in this question were to do with the misuse of scientific words. Diffraction and reflection were frequently interchangeable with refraction. Also many got the wavelengths and colours mixed up although these often gained level one marks for the idea than different colours have different frequencies.

9. This first question to Section C Module P6 was about a logic circuit and calculator display. A substantial number of truth tables were incorrect or incomplete leading to low scoring at levels two and three. There were few correct and complete explanations relating to numbers. But the explanations of logic were more commonly correct. It was aimed at grades up to A and basically it discriminated well across the candidature but particularly at the higher end. About 20% scored five or six marks.

10. This transformer question involved a calculation and some explanations.

a. The labelling of the transformer in part (i) was done correctly by about 50%. Common incorrect responses were ‘inner’ core and step-up transformer. In part (ii), the calculation was better answered than in previous years. Many got full marks here with partial answers (26.6 – missing the final step) gaining one mark.

b. The question asked candidates to explain why transformers require AC. It proved challenging for many who failed to mention the changing magnetic field.

c. With the isolating transformer, many got the idea of the reduced risk of electrocution [1] but not so many scored the ‘isolation from mains’ mark. The question did though discriminate well.

11. This question about transistors received a varied response from candidates. Some seemed unaware of their nature.

a. Most completed the table correctly.

b. In part (i) most knew that I_b is smaller than I_c. For part (ii), most seemed unaware of the transistor and failed to link the small base current needed to switch on the transistor. Candidates often did not mention a large current through the transistor and only made weak references to the emitter current or collector current.

c. Baxter, the robot gave many the opportunity to gain some How Science Works marks. It was usually answered correctly with lots of suggestions.

12. This question was about generators.

a. In explaining the generator many candidates mistakenly described a motor, stating that the coil was forced or made to rotate. Marks were available for the coils turning in the magnetic field producing a current [1]. Also the brushes passing on current to the external circuit gained one mark. Motor explanations were limited to the second of these marking points at best (maximum one mark).

b. In this question about a different generator output, common answers were the reverse of those required. Some candidates did gain a mark for faster coil rotation but also said stronger field or more coils. Only the highest ability candidates gained two marks here.

13. This Section D question on data handling encouraged lots of answers even though the context was unusual and deliberately off the specification.

a. In part (i) few scored all three marks and the majority only one mark, usually referring to the age. Rather fewer mentioned the small test sample. In part (ii), most calculated the average correctly as 19000Hz [2]. Although some treated the average as an included person and quite a few used the wrong column.

b. In part (i) most scored one mark with better candidates scoring the second for correct reference to the frequency. Some didn't spot the frequency loss and there were communication problem with some candidates describing the graph. In part (ii) again there were problems in communicating their ideas. Few answered it fully, using data on frequency, hearing loss and applying this to the function of a hearing aid.

B753 Controlled Assessment

General Comments:

Overall, centres are coping well with the controlled assessment process and some excellent work with good clear marking has been submitted.

Most centres submitted work that was well organised and easy to follow with all of the appropriate documents enclosed and clear annotations explaining why particular marks had been awarded. This aided the process of moderation and centres are thanked for the effort involved.

Some centres, however, are still submitting work with errors of various kinds:

- There has been a number of clerical errors where marks submitted to OCR differ from those on the work sent to the moderator. Centres are advised to double-check the marks on scripts before sending them to the moderator. In particular, if internal moderation has taken place and marks are changed, it needs to be clear which mark is being submitted.

- A significant number of centres have submitted the wrong task for the year. Tasks are only valid for one year and it is not permissible for centres to submit work either using tasks from previous years or from the next year. Any centres that used a task from next year are reminded that they will not be allowed to use this task again in the coming year.

- A number of centres also gave more support to their candidates than is acceptable. No form of writing frame, table grid or guidance notes, other than those provided as part of the task, are allowed to be given to the candidates. Use of such material can reduce the marks available to candidates as their own work has not met the marking criteria.

- Centres are reminded that in signing the CCS160 (Centre Authentication) form they are guaranteeing that the work submitted is each candidate's own unaided work.

Previous reports have given considerable guidance on the application of the marking criteria, how to avoid common errors and the requirements for the award of high marks. Centres are advised to consult the reports written in 2012, 2013 and 2014 in addition to the notes given below.

Comments on each Skill quality:

Research: Work submitted was generally of a high standard. Candidates frequently demonstrated that they were aware of the need to produce a full bibliography with full URLs when referencing internet sites. Few candidates made use of resources other than those on the internet, but when a text book is referenced then page numbers should be given. The range of sources used was generally suitable and relevant to the tasks.

Some candidates put a lot of effort into an analysis of the sources commenting on their likely reliability and accuracy and giving reasons for their decisions. This is not a requirement of the marking criteria and candidates could be advised to use their time to better effect. The main issue for the award of high marks lies in the candidate’s ability to select relevant information from the sources. This needs to be specific to the bullet points in part one and to be scientifically correct. It is rarely possible to effectively fulfil this requirement by simply cutting and pasting from web sites as it usually means that irrelevant material is copied alongside relevant material.

Planning: candidates also generally tackled this effectively. The methods now often include a diagram, which helps to explain the plan and detailed information that can easily be followed by someone else. The most common weakness in this skill quality is an insufficient consideration of how errors can be minimised. This is required at all marking points above two with the difference between three and six being in the depth and detail given by the candidates.

Candidates need to produce a suitable hypothesis. This should be based on the information given in part 2. Candidates make it more difficult for themselves when they choose to investigate something that is not really what the task was asking for. For higher marks candidates need to provide a detailed scientific justification for their hypothesis.

Candidates should clearly indicate any changes they might have made to their plan. For example, candidates need to select a suitable number and range of data points as part of their plan. If the number in the plan differs from the number used in the actual experiment then an explanation of the change should be given.

Collecting: This was one of the highest scoring of the skill qualities. Candidates generally produced clear tables with full headings and units and quoted data to an appropriate and consistent number of decimal places in line with the equipment they had chosen. Some centres penalised candidates for inconsistency or errors in processed data such as averages. Marking in this skill quality need only be applied to raw data. Some centres over-marked by giving high marks when all of the raw data had not been recorded and processed data was shown instead. For example, initial and final temperatures should be recorded and not just temperature change.

Candidates are not allowed templates to use in these tasks. If candidates have been given a table to complete then it is unlikely that they would be able to get many, if any, marks for this skill quality.

Managing Risk: This was also a high scoring skill quality but some centres are still being too generous. The following comment was made on last year's report and bears repeating, as some centres are still failing to take it into account when giving high marks.

The criteria for 5/6 marks state 'All **significant** risks in the plan **evaluated**'. The risk of having a Heart-attack whilst squeezing a clothes peg is not significant. Too many times candidates invent spurious risks. 'Evaluated' means that the candidate needs to appreciate and state whether it is a low risk or a serious risk.

The criteria also states '**Reasoned** judgements made to reduce risks by **appropriate specific** responses'. The highlighted words speak for themselves.

Processing data: Graphs were well drawn by most candidates. However, some centres are still giving high marks when candidates have inappropriate scales on one or more axes. A graph does not need to have the point (0,0) on the scale in all cases. As a general rule the data points should cover at least half of the available space.

Some of the tasks have been designed with the opportunity for more able candidates to use more complex mathematical techniques that are relevant to the task; for example, calculating an energy change. However, candidates do not need to carry out an additional complex mathematical technique in order to get high marks if there is not a process that is relevant and adds to the understanding of the task. For example, calculating a gradient may be irrelevant and provide no additional useful information, particularly when candidates do not understand what the gradient shows.

Without some form of processing of uncertainty then full marks are not available in this Skill quality. Range bars are generally the most accessible method for candidates to use.

Analysing & Interpreting: There were some tasks this year in which candidates failed to obtain data that supported their hypothesis or the hypothesis given. For example, in those who undertook the portable stoves experiment, some candidates failed to control the amount of fuel used in each experiment, by either burning a fixed mass of fuel or calculating a temperature change per gram, and obtained data which showed no real trend at all. Candidates should not try to force their hypothesis on to the data. There were some candidates who were given high marks for stating that a trend was supported when only two out of four data points followed this trend. They may then have commented that the other two data points were anomalies. This is not good science and is not worthy of high marks. Candidates may obtain high marks by pointing out that the data does not show a clear trend, comparing this to data from secondary sources and making appropriate comments to explain the differences.

Evaluating: Although often marked well by centres this continues to be a skill quality that candidates find difficult. This is partly because candidates need more space to answer question four of part three than is available on the standard version. Centres may provide candidates with a reworked version of part three with more space available for answers if they choose to, as long as the wording is identical to that provided in part three. This can be easier for candidates than using additional paper.

Question four of the task requires candidates to evaluate their method, their data and to make comments about risk. Many candidates fill the space available but focus primarily on just one of these issues and consequently can only score low marks.

To obtain high marks candidates need to make a 'detailed and critical consideration' of the data. This is rarely seen. Although range bars are often included as part of processing, many candidates do not understand the significance of them and how they relate to the quality of the data. Where data is of poor quality, candidates need to try to link this to their method and explain why their plan gave rise to data that did not match their expectations or where there were a number of anomalies. Suggestions for improvement should ideally be derived from this rather than chosen almost at random.

Comments about risk do not contribute significantly to the mark for analysis but can be used to further support the mark awarded in the risk skill quality.

Conclusion: As with analysis and evaluating, the conclusion should be based on the actual data obtained. In most cases candidates are justified in saying the data supports the hypothesis but in some cases this is not the case and candidates should say so and go on to explain why.

There is also the requirement in this skill quality for candidates to clearly link their research to their own experiment and to appropriate scientific knowledge and understanding. Question six of part three provides an opportunity for this but it is to be remembered that evidence for any of the marking criteria can be obtained from any part of the candidates' work. Annotation helps considerably if marks awarded are related to work from elsewhere in the task.

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

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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

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