OCR
Oxford Cambridge and RSA

GCSE

Physics B

Gateway Science Suite

General Certificate of Secondary Education **J265**

OCR Report to Centres June 2014

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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.

OCR will not enter into any discussion or correspondence in connection with this report.

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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 75 mark paper gave a wide range of marks and a higher mean (39) than June 2013. 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. Although a few candidates left some answers blank, these 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 and candidates were showing more success on tackling the 6 mark questions than last year. In June 2012 it was evident that candidates found some of the new approaches particularly challenging. For example, the developed calculations, How Science Works and data handling. Developed calculations were often left blank last year but this year this was uncommon and although the developed aspect still proved a challenge for some it was good to see candidates attempt calculations as far as they could take them. In general there was a marked improvement in answers involving calculations and data.

Some candidates however were often unable or unwilling to attempt the 6 mark questions and made no response at all. This is a pity as many answers were given full marks for short and concise answers.. There also appeared to be 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 unsure how to tackle the questions.

Comments on Individual Questions:

Question 1

This question about lasers was generally well answered with most candidates getting 3 or 4 marks.

a Most candidates referred correctly to the heating effects of lasers [1] and often described the beam as narrow, concentrated, focussed or intense [1]. Most answers achieved at least one mark.

b About half of candidates attempted this question (although a limited number failed to realise it was a question) and could draw 2 – 5 reflections from the sides of the fibre [1]. Common errors were when large numbers of reflections were drawn [0]. Also often seen were single curved lines along the middle of the fibre [0].

c Most gave at least one use of lasers: gun sights, eye surgery, laser pointers and bar code scanners were common correct answers. Common unsuccessful answers were 'disco lights' and cutting materials (already in the question) [0].

Question 2

This question on microwaves was generally well answered. It gave a range of marks and discriminated well across the grades.

a Mostly correct efficiency calculations of 80% or 0.8 [2].

b This was a different way of approaching data and the concept of efficiency. It was answered well with most responses showing 50% efficiency in the table. Other answers such as 'the energy absorbed is half the input' also gained the mark.

c This three mark question invited candidates to describe an experiment to find the fastest cooking oven. Some had ideas on measuring times / temperatures or using stopwatches / thermometers [1]. Some also had an idea of controlling variables, eg same amount of same food [1] or heat each for the same time [1]. Rather fewer could describe the end point convincingly. Eg. time how long it takes to heat the foods by 50^0C. Most were more vague and used phrases like 'time how long it cooks for', etc.

Question 3

This was a six mark extended prose level of response questionand was targeted at the lower grades G, F and E. Most candidates calculated the temperature rises correctly to satisfy the level 1 criterion. Most answersalso went on to also select C as the best choice for keeping the drink cool [4]. Level 3 answers needed some scientific explanation about shiny surfaces reflecting the IR radiation or energy away. Others answered in terms of the bubbles trapping air leading to good insulation.

Question 4

This question was about UV light and its risk to humans. It was well answered with most candidates getting 3 or 4 marks.

a Well answered, with most writing about short hair failing to protect the skin (from UV) [1].

b Most answers described some comparison between sun beds and sunlight [1]. Many also advocated surveys of people or fair tests on people [1].

ci Just over half of candidates failed to score on this question. Those with some success generally gained [1] here in explaining why dark skins reduced skin cancer risks. Common answers were that dark skin absorbs more UV [1]. Also many referred to extra pigment [1] whilst fewer mentioned that less UV gets to lower healthy skin [1].

cii Using the data in the table about a third indicated that both A and C would be the safe choices.

Question 5

This electromagnetic spectrum question was answered completely correctly by over half of candidates.Most got X-rays in the right place for [1] mark. Microwaves and visible were often the wrong way round [0].

Question 6

a This calculation was done very well. Most calculated the 3450 correctly [2] and identified the water heater [1]. Only a minority could answer that W or watts was the unit of power. Common incorrect answers were joules, amps and volts.

b Usually correct with 'the amount of time it is used for' [1].

Question 7

This question about nuclear power generation included one question about How Science Works and another on transformers. Candidates found it challenging and very few scored full marks on the whole question.

a This HSW question focussed on the risks of nuclear power generation and how to reduce these risks. Most candidates mistakenly thought that nuclear power stations continuously emit dangerous levels of radiation. Better answers described 'leaks' or 'reactor problems' that allowed radiation to escape' [1]. Management of this risk such as creating a no-go area in such an emergency gained [1]. Nuclear waste being buried in glass deep underground was also a common answer [1].

b About a fifth knew that (these) transformers changed the voltage [1]. Rather fewer went on to say they increased or stepped-up voltage [2] and that this was more efficient [1].

Question 8

This question was about space travel and it was a successful source of marks for many. Most candidates scored 3 or 4 marks on the whole question.

a 'Telescopes' was given by many [1],although satellites and microscopes were common incorrect answers.

b Most worked out that Mars and the Moon were considered because of their close proximity to Earth [1].

c Most knew it would be dangerous to go near black holes (too vague) [0]. Better answers focused on their very high gravity or being uncontrollably sucked in(to) the black hole [1].

d Amongst long lists of desirable (but unessential) items most candidates included water, oxygen or food [2].

Question 9

This question was about space and it gave some good answers and some interesting ones too.

a Many knew that The Big Bang was an explosion which created the Universe [1]. Some thought it just created the Earth or the Earth and moon system [0]. Some thought that it was when rocks collided [0].

b This 3 mark question on asteroid impact and its effect on dinosaurs revealed a few misconceptions. Many thought that all the dinosaurs were individually hit by the asteroids. Others thought the asteroids would cause earthquakes and volcanic eruptions [0]. Better answers described the dust being cast into the atmosphere [1] reducing the sunlight [1] and causing climate change [1] or food shortages [1].

Question 10

This 6 mark question on thickness monitoring of paper using beta radiation was targeted up to grade C. It proved particularly challenging at level 3 where only strong grade C candidates tended to thrive.

At level 1, many knew that beta radiation penetrated paper OR could give a simple safety point (eg. wear a protective suit). Level 2 answers needed to cover both of the above points. At level 3 the safety points had to be realistic (eg. shielded source) AND the partial penetration idea (less beta gets through thicker paper). Most answers fell into the level 2 category.

Question 11

This question involved graph work for speed, an acceleration calculation and a description of KE and GPE. Most candidates gained over half marks on the whole question.

a Most described the graph well, with A showing steady speed [1], B showing Ben as stationary [1] and C as a faster speed [1]. Common errors were to omit 'steady' for part A. More fundamental concerns were from those answers who thought Ben was accelerating (A), steady speed (B) and accelerating again, faster, in C [0].

b The acceleration calculation was usually correct for [2] marks.

Question 12

a Kinetic energy was linked to movement [1] and GPE was linked to height of the potential to fall [1] for successful answers. Often though, only [1] mark would be scored here for GPE.

bi The momentum calculation was usually correct [2].

bii This question on terminal speed saw candidates struggling to communicate their ideas clearly. Good concise answers such as 'it is when drag = weight scored [2]. Gravity = air resistance was common [1] as was gravity = upthrust [0]. Some also realised that terminal velocity meant zero acceleration [1].

biii A common misapprehension here was highlighted by the many answers describing the moon as having no gravity. Better answers referred to the lack of atmosphere or air resistance [1].

Question 13

This six mark extended prose level of response question was targeted up to grade C. It was about seatbelts and most candidates were willing to answer. Most calculated the force correctly (level 1 – [2] marks) and described the simple action of the seatbelt (eg. 'stops driver hitting windscreen). Both these qualified for level 2and [4] marks. Better answers at level 3 needed to link the longer (stopping) distance or (stopping) time to the lower acceleration or forces. This discriminated well with only strong grade C candidates gaining [5] or [6] marks.

Question 14

This data handling question on cars was answered well although the more challenging later part discriminated well. Most scored 2 or 3 marks overall.

a Most gave C as the correct answer [1].

b Most again gave C as the correct answer [1].

c About a third of answers indicated that D and E were the odd ones out [1]. About half of these went on to describe the general trend between engine capacity and top speed [1].

Question 15

a Most knew that the car needed charging but failed to mention the importance of the mains or solar cells as the source. A proportion also failed to mention the battery [1]. Concise and successful answers were seen such as ‘charge the battery from the mains’ [2] or ‘the solar panel recharges the battery’ [2].

b Answers referring to electric cars having a short range were worth [1] mark. Eg. ‘battery runs flat quickly’ [1] or battery goes flat and there isn’t enough places to charge it’ or ‘it takes a long time to charge [1].

B751/02 Unit 1 – Higher Tier

General Comments:

This 75 mark higher tier paper gave a good range of marks (0 - 72) and a higher mean (40) than June 2013. The answers showed that candidates generally were well prepared and the majority appropriately entered for this tier.

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 6 mark questions than last year. Developed calculations were often left blank last year but this year this was uncommon and although the developed aspect still proved a challenge for some it was good to see candidates attempt calculations as far as they could take them. In general there was a marked improvement in answers involving calculations and data.

There appeared to be an abundance of candidates continuing answers on extra booklets several using a sheet for just one or two words. 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 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.

Comments on Individual Questions:

Section A

Question 1

This question was about UV light and its risk to humans. It was well answered.

1 (a) Most wrote about short hair failing to protect the skin (from UV).

1 (b) Most answers described some comparison between sun beds and sunlight. Many also advocated surveys of people or fair tests on people.

1 (c) (i) Most gained [1] here in explaining why dark skins reduced skin cancer risks. Common answers were that dark skin absorbs more UV. Also many referred to extra pigment, whilst fewer mentioned that less UV gets to lower healthy skin.

1 (c) (ii) Using the data in the table, most indicated that both A and C would be the safe choices.

Question 2

This question was about microwaves.

2 (a) Candidates found this question challenging. Most candidates were able to explain that microwaves penetrated the potato whilst infrared waves heat the surface but few were able to apply this to crisping the skin by evaporating all the water from the surface.

2 (b) Most candidates correctly said that microwaves penetrate further than infrared so less distance is needed for conduction to the centre which was one marking point but did not complete the answer with a second reason that microwaves are only absorbed by the food or infrared waves need to heat the oven/ container /plate.

2 (c) Examiners were looking for the idea that it takes a long time for the infrared energy to reach the centre and cook the food so only the microwaves can cook the food in 8 minutes, so the infrared has little effect on cooking the potato in the first 8 minutes.

Question 3

This was a six mark question targeted up to A*

Most candidates achieved level 1 by knowing that the power of the kettles and the mass of water in each kettle were the same. A significant number of candidates went on to say that the difference in mass between the kettles was not significant, which was incorrect. Similar statements about the specific heat capacity of the material of the two kettles were also made, again incorrect. About half the candidates realised that the effect of greater mass of kettle and lower specific heat capacity cancelled the smaller mass and higher specific heat capacity. Most of these candidates proved this by calculation to gain level 2. To achieve level 3, candidates needed to do the above calculation and give a full qualitative explanation of the two situations. The terms heat capacity and specific heat capacity were (incorrectly) freely interchanged by many candidates but this was not penalised.

Question 4

This electromagnetic spectrum question was answered correctly by most candidates.

4 (a) Candidates correctly put the waves of the electromagnetic spectrum in the correct order. The table was split into two, one mark awarded for each correct part.

4 (b) Candidates were asked for a definition of frequency. Correct responses varied from “the number of waves per second” to the standard definitions found in most physics textbooks

4 (c) This question challenged the candidates with approximately 20% scoring full marks. Most candidates realised that they needed to calculate frequency and scored 1 mark for using the wave equation correctly. Marks were then awarded for correctly calculating the two frequencies and finally a fourth mark for subtracting the frequencies. A main source of error was to subtract the wavelengths and then use the wave equation which was incorrect because of the inverse relationship. A second error occurred after candidates had correctly calculated the frequency of one wave as 4.05×10^{14}Hz and then went on to cross out the 5 and replace it with a 4 – thinking there was an error in their calculation.

Section B

Question 5

This question about nuclear power generation included one question about How Science Works and another on transformers.

5 (a) This HSW question focussed on the risks of nuclear power generation and how to reduce these risks. Most candidates mistakenly thought that nuclear power stations continuously emit dangerous levels of radiation. Better answers described 'leaks' or 'reactor problems that allowed radiation to escape'. Management of this risk such as creating a no-go area in such an emergency gained 1. Nuclear waste being buried in glass deep underground was also a common correct answer.

5 (b) Many knew that these transformers changed the voltage and most stated that the voltage increased or was stepped-up voltage. Rather fewer went on to say that this was more efficient or wasted less energy. Examiners did not allow *stops* energy loss as an answer. The question specifically asked about the transformers that connected power stations to the National Grid. A significant number of candidates went on to write about the whole of the National Grid and the use of step down transformers to supply electrical energy to the home. Provided the first part was correct these were not penalised but wasted time in giving their answer.

Question 6

This question was about comets and asteroids

6 (a) (i) Most candidates knew that a comet can be seen when it is near the Sun and the majority of these candidates stated that it was because the ice melted and left a tail which reflected light from the Sun. A significant number of candidates said approaching the Sun, this was not allowed as the comet approaches the Sun from the furthest point of its orbit until it passes the Sun.

6 (a) (ii) Examiners were looking for elliptical either in writing or as a diagram. They were tolerant of those approaching the correct shape, for example, squashed circles. Most candidates correctly identified the increase in speed as it approaches the Sun and went on to say that the gravitational force increased as the comet got closer to the Sun. Examiners accepted the word gravity but would have preferred expressions such as the force of gravity to be used.

6 (b) (i) Candidates found this question difficult . Examiners were looking for one of three ideas: they are small, they are far away, they do not give out light.

6 (b) (ii) Candidates were asked about the advantages and disadvantages of using a missile to protect the Earth from NEOs. Candidates performed well on this question and often wrote at great length. To score the full 3 marks at least one had to be an advantage and one a disadvantage. The most common advantage was that it would destroy / shatter the NEO. The most common disadvantage was that the fragments would still hit the Earth.

Question 7

This question ,worth six marks, was about a pumped storage system.

There was some confusion as to how this system worked even though the basic operation was given in the question. Weaker candidates thought it replaced conventional power stations when demand was low. The majority of candidates, however, reached level 2 with about 10% going on to reach level 3. Candidates were able to comment generally on the system and link either the power station to the pumped storage system to demand. Few candidates linked the two systems together: when demand for electricity was low, energy was stored in a high level reservoir and when demand was high, this stored water was used to generate electricity.

Question 8

This question was about generating electricity.

8 (a) Most candidates understood that a thermal power station involved heat.

8 (b) Most candidates produced the standard answers of renewable energy, less polluting gases, less use of fossil fuels.

8 (c) This question was a developed calculation. The majority of candidates successfully completed the first part of the calculation and calculated the energy loss each second as 330MJ but could not complete the calculation to find the energy lost each minute. Candidates were credited at each stage of the calculation.

Section C

Question 9

9 (a) Most candidates successfully calculated the average speed as 1.25m/s.

9 (b) Most candidates were able to calculate the speed in part C as 2 m/s

Question 10

10 (a) (i) Almost all the candidates identified C as the most economical car.

10 (a) (ii) Most candidates were able to give reasons why Daisy did not get the same fuel consumption as the manufacturer.

10 (b) Candidates were asked about the advantages and disadvantages of electric cars. Some of the most common advantages were ‘cheaper to run’ no emissions at point of use’ and common disadvantages were ‘limited range’ and ‘few recharging points’.

Question 11

This six mark extended prose level of response question was about seatbelts. Most calculated the force correctly (level 1 – [2] marks) and described the simple action of the seatbelt (eg. ‘stops driver hitting windscreen). Better answers at level 3 needed to link the longer (stopping) distance or (stopping) time to the lower acceleration or forces.

Question 12

This question was about the transfer between kinetic energy and gravitational energy for falling objects. Candidates struggled with both parts of this question.

12 (a) Candidates were asked to calculate the distance a rock fell from a cliff. They were given the hint that it gained kinetic energy and lost gravitational potential energy. Despite this hint only about one in five candidates scored on this section.

12 (b) Candidates were asked why a rock of double the mass hit the ground at the same speed. Examiners were looking for the idea that mass cancelled out in the two equations or that all objects fell with the same acceleration due to gravity. Many candidates mistakenly confused mass and weight.

Question 13

13 (a) This question asked candidates about how escape lanes reduce the braking force needed in an emergency. For those candidates who had not heard of them a drawing and description was provided. They were asked how escape lanes Examiners were looking for the idea that the sand increased the friction on the tyres and so slowed the vehicle down or that going uphill increased the GPE so reducing the KE of the car. The majority of candidates were able to applyr their knowledge to this new situation.

13 (b) This was a ‘how science works’ question. Candidates were asked how wearing seatbelts gave risks and benefits to the passengers and the wider community. Expected correct answers included the risk of being trapped in an accident, risks of injury including cracked ribs or whiplash, benefits of reduced injury in a crash such as preventing the head hitting the windscreen and benefits to the community such as the reduction in the number of deaths or serious injuries resulting in reducing hospital costs.

B752/01 Unit 1 Foundation

General Comments:

This 85 mark foundation paper gave a good range of marks (3 to 67) and a higher mean than June 2013. The answers showed that candidates generally were well prepared and appropriately entered for this tier. A small number of some 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 evidence that some areas of the Specification have been covered less well by many candidates, most notably the action of lenses and the comparison of wave behaviour in satellite communications.

It was good to see candidates attempt calculations throughout the 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.

Most candidates attempted the 6 mark questions on resistance and transformers. The 6 mark question on lenses was less familiar and proved to be very challenging to most.

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 often did better than in the rest of the paper. It was pleasing to see that this section was accessible to the full range of candidates.

Comments on Individual Questions:

Question 1.

This question about waves was generally well answered.

ai Nearly all could identify a compression on a longitudinal wave.

aii Recognising the distance between the same point on consecutive waves as wavelength discriminated very well. This proved to be far more challenging than when presented as the distance between two consecutive compressions.

b On this 2 mark question most candidates stated that the ultrasound could not be heard as the frequency or pitch was too high [1]. Better answers qualified that by adding the upper threshold of 20 000Hz [1].

c In general this question on how ultrasound is used in pre-surgical diagnosis was answered well across the full range. Most candidates scored at least one mark for either identifying the location or the nature of the problem.

Question 2.

This 6 mark level of response question was targeted at grades up to C. It was accessible to the full range of candidates. Most were able to calculate resistance accurately and more able candidates went on to describe the relationship between length and resistance. Level 1 responses often described the relationship between length and current or simply completed one correct calculation of resistance.

Question 3.

This question was about background radiation and gave a bar chart as a stimulus.

ai Most candidates interpreted the information in the bar chart very well

aii There were very few correct responses in suggesting why a country has a higher natural background count rate. Most answers referred to artificial contributions to background radiation.

b Despite the fact that the use of tracers in identifying leaks or blockages was a 6 mark question in 2013, only higher ability candidates tended to score on this question.

Question 4.

This question on nuclear decay was quite well answered across the full range of candidates.

ai Most knew the activity had reduced [1] and many went on to say or describe in numbers that it had halved [2].

aii Many gained [1] for sketching the graph with a longer half life. The most common error was the graphs crossing usually around 6 to 8 days. It was encouraging to rarely see graphs with a shorter half life [0].

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.

bii In general most knew that beta and gamma radiation can penetrate skin. The most common error was to identify that gamma only can penetrate skin.

Question 5.

a This question on Spray painting was accessible by most candidates who often scored at least [1] mark. The best answers included a detailed description of how the electrostatic paint spreads more, due to the like charged paint particles repelling. Weaker candidates often simply described the attraction between the paint and the object.

b The explanation of electron movement and earthing was poorly described by most candidates. Very few achieved [2] marks.

Question 6.

This question about satellites and particularly their use in communications proved to be very challenging for candidates across the full range. It was clear that the area was very unfamiliar to most.

a Very few could describe the advantages of satellites in geostationary orbit for TV signals.

b Even fewer could compare microwaves and radio waves used in satellite communication.

c Most stated that low polar satellites were faster or took less time to orbit.

d Most could state at least one benefit (usually spying or space exploration) or one risk (usually collision) of putting satellites into space. Most commonly full marks were not gained due to a repetition of uses already given earlier in the question.

Question 7.

This calculation question on kinematics discriminated very well.

a Few candidates could calculate average speed and therefore distance travelled. The majority simply multiplied one of the two given speeds by the time taken.

b Many scored [2] on this calculation of final speed.

Question 8.

This 6 mark level of response question on an investigation to determine the focal length of different thicknesses of convex lenses was targeted at low demand up to grade E. In general the quality of response across the whole range was poor. It was clear that few candidates had undertaken the practical investigation into creating a real image from a distant object by a convex lens on a screen. Better candidates could describe focal length and some candidates achieved a Level 1 by describing how the focal length varies with thickness. This was clearly more familiar as it has been assessed in written papers in the previous Specification.

Question 9.

This question on projectiles gave a good range of marks and discriminated well across the candidature.

a In describing how the launch angle affected the range most referred to the optimum angle being 45^0 or that the range reduced as the angle increased (after 45^0). Some got the increasing range to 45^0 maximum then a falling range at greater angles [2]. Answers often referred to height rather than range and this limited the marks awarded.

b Most chose 90^0 [1] as giving the optimum height.

ci The shape was rarely described correctly as parabolic or a parabola [1]. Arch, curve, humped, semi-circle were common wrong answers.

cii Some realised the vertical velocity was reduced by gravity [1] but very few realised that acceleration was unaffected [1].

ciii Very few appreciated that the horizontal velocity was unaffected by gravity.

Question 10.

This question about semiconductor devices of LDR, thermistor and diode was poorly answered.

a Surprisingly few candidates recognised the symbols for LDR and thermistor. Most of those who did could then describe how resistance varied with light intensity or temperature.

b Few candidates knew the symbol for diode [1] but when it was correct a second mark was usually gained for being in forward bias.

Question 11.

This 6 mark level of response question on transformers was targeted up to grade C.

For level 1, examiners were seeking to award marks for a description of the observed similarities in the construction of two transformers. For level 2, most candidates gained a partial match for a correct description in similarities and differences in construction. Some candidates went on to compare the output voltages arising from the different turns ratios of the transformers. However, very few candidates reached a secure level 3 which required a comparison of the applications of a step up or step down transformer.

Question 12.

This question on logic gates was answered particularly well across the full range.

a Over half completed the truth table for a not gate.

bi Almost all recognised inputs to gates.

bii Only the weakest candidates failed to identify the output of a not gate.

biii About a third could process the outcome of an extended 3 input, three gate network.

Question 13.

With the exception of the description of ohmic behaviour, this question on resistance was answered well by most candidates.

a Very few described that a straight line relationship between current and voltage on a graph passing through the origin indicated ohmic behaviour.

bi Most read data from the graph accurately.

bii Most selected the correct calculated resistance.

c About half knew that the lowest gradient had the highest resistance

d It was encouraging to see that most could recognise the faults in the description of current as flow of neutrons, and that resistance was not independent of temperature. The most common incorrect correction was stating that resistance decreases with increasing temperature.

Question 14.

This question on electric motors was quite well answered.

a The vast majority could describe examples of the application of motors in household appliances.

b This “how science works” question involved choosing the most efficient motor using data across a range of currents. Although most candidates could correctly identify the best choice of motor most struggled to explain two acceptable reasons for this choiceusing the data provided.

Question 15.

This data question on noise levels was accessible to the full range of candidates.

a Almost all selected the 4 loudest sounds.

bi Most scored [1] mark for loudness decreasing with distance from source. Very few gained [2] for interpreting the decreasing gradient as the rate of decrease dropping with increasing distance.

bii Most used the graph correctly to find the loudness. When mistakes were made it was usually due to incorrectly reading from the loudness axis rather than incorrect construction of lines on the graph.

biii Almost all scored at least [1] and many scored [2] for loudness being too high very close by or that the walls or windows blocked sounds.

ci Almost all interpolated correctly within the allowed range.

cii Most recognised the mathematical symbol correctly. Often the mark was not gained due to describing it as “4 minutes or less”.

diii This discriminated well with very few candidates able to process the data (showing exponential decay in exposure time with loudness) to calculate loudness.

B752/02 Unit 2 Higher

General Comments:

This 85 mark higher paper gave a good range of) and a higher mean (39) than June 2013. The answers showed that candidates generally were well prepared and appropriately entered for this tier. As always though, some 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 6 mark questions than in the past. Developed calculations were often left blank last year but this year this was uncommon and although the developed aspect still proved a challenge for some it was good to see candidates attempt calculations as far as they could take them. In general there was a marked improvement in answers involving calculations.

Some candidates however were often unable or unwilling to attempt the 6 mark questions and made no response at all. This is a pity as many responses achieved full marks for short and concise answers. There also appeared to be 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 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 showed improved performance on last years.

The 10 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 through into this section and coped well with the maths and written answers.

Comments on Individual Questions:

Question 1.

This question about waves was generally well answered.

ai Candidates were asked to describe a compression. Many correctly referred to the parts of the wave where particles were close together whilst others labelled a compression on the diagram [1]. Some answers referred to the high pressure or density regions [1]. Common incorrect responses often referred to waves, frequency or wavelengths being close together [0].

aii The question asked for the comparison between particle movement in longitudinal and transverse waves. One mark was available for the simple distinction of vibrations along the wave versus vibrations across the wave. Further marks required more precision in explaining the movement in each wave. This meant reference to both the wave direction and the particle direction. Eg a typical full answer such as 'longitudinal wave particles vibrate parallel to the direction of the wave [1] whereas transverse wave particles vibrate at 90^0 to the direction of the wave' [1]. As this answer also showed the distinction between the two wave it qualifies for [3] marks in total. Many candidates gained marks from diagrams and often they found it easier to communicate in this way.

b On this 2 mark question most candidates stated that the untrasound could not be heard as the frequency or pitch was too high [1]. Better answers qualified that by adding the upper threshold of 20 000Hz [1].

Question 2.

This 6 mark level of response question was targeted at grades D up to A*. It discriminated well and gave a useful range of marks. Level 1 answers were confined to a simple calculation of a simple idea of how a fuse works. Most answers fell into level 2 where answers had to show a correct calculation of 3.26A or 3.3A and an explanation of how a fuse works (eg. too much current blows the fuse). Level 3 answers were naturally less common but needed in addition explanations as to why the 5a fuse was best and why the 13A fuse was a poorer choice. Some candidates calculated the power ratings but failed to capitalise on ideas of current and fuses.

Question 3.

This question was about background radiation and gave a pie chart as a stimulus. It was generally well answered.

a In explaining why different people get different doses of radiation many answers referred to those working with or being treated by medical **radiation**. **Nuclear** power station workers were also a common correct answer. Often though these answers were too vague and referred to the risks of working or living near 'power stations' or 'hospitals' [0]. Many mistakenly assumed that if you worked in a hospital you would be automatically exposed to more radiation. Radon and granite were often seen as extra factors as was different foods and diets [1]. Again some answers were vague such as 'people have different lifestyles' [0].

b Most gained at least 1 mark on this 2 mark how science works question. These usually referred to showing changes over time [1] or across different areas [1]. Sharing of results so they could be checked, compared or used was often seen too.

Question 4.

This question on nuclear decay was quite well answered given that it was targeted at the full range of demand for this higher paper.

ai Most knew the activity had reduced [1] and most went on to say it had halved [2].

aii Most gained [1] for sketching the graph with a longer half life. Common errors were not starting at 120 or the graphs crossing usually around 6 to 8 days. It was encouraging to rarely see graphs with a shorter half life [0].

b This was an intentionally demanding question on nuclear decay. Some candidates scored both marks here for rubidium correct [1] and beta correct [1]. One mark was commonly seen with the typical error showing a 1 rather than -1 on the beta symbol.

Question 5.

a Spray painting was well understood by most candidates who often scored 2 or 3 by completing the sentences.

b The electron transfer was less well explained. Candidates needed to refer to the paint or spray to qualify for the mark here. So electrons from gun to paint [1] or from paint to object [1] were the usual successful route. There were some who missed out the paint saying 'electrons go from the gun to the object' [0]. Occasionally references to 'positive electrons' were seen [0].

Question 6.

This question on projectiles gave a good range of marks and discriminated well across the candidature.

a In describing how the launch angle affected the range most referred to the optimum angle being 45^0 or that the range reduced as the angle increased (after 45^0). Some got the increasing range to 45^0 maximum then a falling range at greater angles [2]. Answers often referred to height rather than range and this limited the marks awarded.

b Most chose 90^0 [1] as giving the optimum height.

ci The shape was often described correctly as parabolic or a parabola [1]. Arch, curve, humped, semi-circle were common wrong answers.

cii Some realised the vertical velocity was reduced by gravity [1] but very few realised that acceleration was unaffected [1].

ciii Rather more appreciated that the horizontal velocity was unaffected by gravity.

Question 7.

This question about satellites gave opportunities for extended written answers. Low polar and geostationary satellites were better understood than in previous seasons.

a Most correct answers described geostationary satellites as being over a fixed point [1] above the equator [1]. Also for this marking point the 24 hour orbit was often mentioned. Many also went on to gain the third mark for the idea that this orbit maintains a line of site to their receivers or transmitters [1]. This was often explained in different ways such as 'so the satellite dished can always point the same way at the satellite' [1].

bi Most worked out that the orbital period would restrict photographic opportunities [1] of the storm.

bii Most stated that low polar satellites were faster [1] because of the larger force of gravity on them [1]. Better answers also related this to centripetal forces too [1]. Some answers were unclear in not referring to the forces – eg. 'strong' or 'bigger gravity' rather than stronger gravitational **force**.

Question No 8.

This 6 mark level of response question on momentum was targeted at grades D to A*.

For level 1, examiners were seeking to award marks for an idea of momentum OR an idea of equal and opposite forces. For level 2, answers needed to show a momentum calculation (commonly seen eg. Momentum= 300 and -300) OR an explanation of momentum or forces.

For level 3 we were looking for higher mathematical ideas (eg. 60 x -5 + 100 x 3 = 0) and an explanation in terms of momentum and forces. There were few 6 mark answers although 5 marks were awarded commonly at this level. Often at this level answers had secure ideas on momentum but the idea of equal and opposite forces was less well understood or communicated. Many level 3 answers stated that the forces were equal and opposite but went on to say that the force on Matt had to be greater than Nina's.

Question 9.

This question was about light and its theories.

a Most answers conveyed the idea that the waves behaved like light in that the angles of incidence and reflection were equal. There were frequent references to interference and critical angle. Many unsuccessful answers failed to mention angles at all – eg 'they reflect the same' [0].

b This, for a higher demand question was well answered. Most correct answers referred to interference or diffraction supporting wave but not particle theories.

c This question asked for constructive and destructive interference to be explained. Many good answers used diagrams of waves combining. Others described them (often less successfully) in words only. Here answers had to describe with some care waves being in phase or out of phase.

Question 10.

a LDR's and thermistors in terms of resistance were better understood this year.

b The graph of the diode proved to be a challenge for many. Marks were available for current passing when a threshold voltage is reached (rarely seen) [1], in one direction (common answer) [1], when the voltage is positive or when the resistance is low (not often seen) [1].

Question 11.

This 6 mark level of response question on transformers was targeted at grades D to A.

For level 1 examiners were seeking to award marks for a description of the construction or a similarity and a difference in construction. For level 2 most gained the marks for a correct calculation of output voltages. Level 3 answers also required an explanation of induction and this was rare to see.

Question 12.

a The NOR gate table was completed correctly by about a third of candidates.

b This table was completed correctly by about half of candidates.

Question 13.

a Most candidates used the graph and calculated the resistance correctly.

b Most answers selected E and stated that longer wires have a higher resistance or a lower current. Very few referred to the gradients in the graph to get the second mark.

c Most spotted and corrected the three mistakes to get [2] marks.

Question 14.

This question on electric motors was quite well answered.

a About a third of answers were correct.

bi Suggestions for changing the speed of **this** motor often referred inappropriately to field strength, magnets or the number of turns. Better answers referred to using a variable resistor (rarely seen) [1] or either changing voltage or current [1].

bii Most stated that the speed fluctuated [1] and some linked switching on as high speed and off (or low) as lower speed [2].

biii Some answers described the speed as having less variation [1].

Question 15.

a This calculation was mostly correct.

b This calculation was mostly correct.

c Most chose beaker B as the response and went on to select liquid X [1]. Better answers also described the unknown liquid as denser than water [1] and oil [1].

di Most described the density trend and correctly related it to temperature. Some answers omitted temperature completely.

dii Most answers restricted their descriptions of the graph to the portion after 6^0C. This meant they missed out the key points of density rising to a peak at 5 or 6^0C and then falling with increased temperature.

diii In this question most stated that ice floated on water as its density is lower than water. Very few realised the water's temperature increased with depth.

B753 Controlled Assessment

General Comments:

Controlled assessment in its present form has now reached the half way point. This is the third year of its life and there are three more to go.

The addition of 'Extended Science' to the range of options available proved popular with some centres.

Centres are, in general, coping more efficiently with the system and some excellent work accurately marked was seen particularly in the separate sciences.

There were, of course, some exceptions and a number of centres used tasks from last year or from next year in error. This mistake will not disadvantage candidates but the centres concerned will be forbidden to use the same tasks for next year's assessment.

There seemed to be fewer large adjustments to the marks given by Centres as a result of moderation though, of course, there were still some which marked over-generously.

Most centres annotated candidates' work to show/explain where marks had been awarded. This aided the process of moderation and Centres are thanked for the efforts involved in this annotation.

Most centres also submitted samples of work which were well organised and securely fastened together. Moderators are grateful for this as, again, it makes the process of moderation more straightforward.

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

There were a small but significant number of centres where too much assistance had clearly been given to candidates. In a few cases two or more candidates were found to have completely identical work.

In previous years, comments on individual Skill Qualities have concentrated on how centres could avoid common errors in the interpretation of the criteria. Centres which feel the need for such guidance should consult the reports written in 2012 and 2013.

This year the report will deal with strategies to ensure that candidates score well in each Skill Quality. Some of the points made will, of course, be the same.

Research

Candidates should focus on the bullet points from Stimulus Sheet 1. They should deal with each of these points separately and ensure that each question posed is answered fully. It should be clear from references within the text where the information was sourced from.

It is not necessary to produce extensive research notes. The inclusion of material which is not relevant to the Bullet Points reduces the mark available as the candidate has not demonstrated their ability to 'select' the information which is relevant. Quality is much more important that Quantity.

Planning

A hypothesis, where appropriate, should start with the prediction and follow it with a scientific explanation of the reasons for making it. It need not be unnecessarily long.

Whilst not being essential, it is helpful if the variables which are part of the task are listed and an explanation of each including control where possible is given.

It is also helpful if apparatus to be used is listed and the reasons for choosing are given. This allows candidates to fulfil the criteria of 'ensuring accuracy' and 'avoiding errors'.

A plan should be detailed and step by step. Details of how to set up apparatus should be given where appropriate (a diagram can be helpful here).

The plan should give details of the range of values to be investigated and of the number of replicates to be attempted.

It is not necessary to introduce a moderation, though if the planned method is changed the reason for this should be given.

The plan should always be designed to produce numerical data which can be displayed as a graph (see Processing).

Collecting Data

Structure is more important than neatness. A very neat table which is confusing or incomplete is not worth the highest marks. A table laid out logically with appropriate headings and units where it is easy to understand how the data relates to the task and where all the raw data is included is worth high marks even if it is not very neat.

If all the data is there, well organised, easy to understand and with correct headings and units, centres should not be afraid to give full marks.

Managing Risk

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 state '**Reasoned** judgements are made to reduce risks by **appropriate specific** responses'. The highlighted words speak for themselves.

Processing data

To gain the higher marks a graph is essential and all tasks are designed so that they produce data suitable for graphing. Key words in the 5/6 criteria are 'scales and axes selected' These should be selected so that the correct data is accurately plotted to produce a graph which fills at least half of an A4 sheet of graph paper (this is the graph not the grid which it is plotted on). A line of 'best fit' is usually a straight line or a smooth curve. Neither should be artificially forced to go through the origin, which is not usually a point.

A treatment of uncertainty such as range bars is essential for 6 marks.

If a plan does not aim to collect a sufficient range of data then a suitable graph cannot be drawn and the higher marks are not accessible.

Analysing and Interpreting data

A correct description of the trend is required; the one shown by the data, not the one predicted by the hypothesis (though they should be the same). This should be linked to data (or the graph). Some scientific explanation for the trend is required though this could be credited if it present in the Conclusion.

Secondary data should not merely be mentioned but' links between primary and secondary data evaluated' Reasons for any differences should be explored. There should also be an analysis of 'the treatment of uncertainty'. Scoring 6 marks here is not straightforward and additional space may be required (see comments below).

Evaluating

A relevant comment about the data is essential. No data is perfect, candidates should refer to their range bars if present. They should comment on differences between replicates and how the points drawn relate to their best fit lines. Too many candidates seem to think that they gain marks from having accurate data, not in this skill quality.

Once weaknesses in the data have been identified remedies need to be suggested. It is not sufficient to say what went wrong. How to do it better next time is what is needed.

A simple statement such as use a video camera or use a data logger is not sufficient. Why would this be better?

Consider the words 'detailed and critical consideration' and 'suggestions for improvements justified'.

Justifying a Conclusion

Here the words 'critical analysis of the data' make it clear that a simple statement of “my results support the hypothesis” is not sufficient. Is there any doubt? Could they be interpreted differently? Please note also the words 'from research and investigation' this is where the answer to Q6 comes in.

However the most important words are 'clearly linked to relevant scientific knowledge and understanding'. The science used in the explanations in questions 5 and 6 must be known and understood not just half remembered from an earlier lesson. Good focussed research notes help here.

Comments

Candidates should not feel constrained by the space allocated in the Part 3 answer booklet. They can, of course continue on additional sheets which they should label unambiguously.

However, candidates are pre-programmed to write sufficient to fill the space provided and so a better solution is to create a Centre version of the booklet.

As long as the front page is retained and the wording of the questions are identical, the space allowed for answers can be as large or as small as you wish.

Such an answer booklet does not count as a writing frame as no guidance as to what to write is given.

Problems with Individual Candidates

If a candidate is absent for the research section of the task and there is no time for the task to be completed before part 3 is undertaken then the candidate will have to work without research notes and will be disadvantaged particularly in answering question 6.

If the candidate is absent for the planning stage then they may be given the plan of another candidate (but not a teacher plan). They will score zero for planning but can access all other marks.

If a candidate's plan is so poor that it will not work or is dangerous, they can again be given the plan of another candidate. Their own plan should be marked and they keep that mark for planning but, thereafter, marks may be based on the alternative plan.

Much the same applies to a candidate whose results are very poor. They should be given a mark for their own results under collecting data but can then be given the results of another candidate to use for processing etc. It is recommended that such candidates use their own results for the Evaluation section.

If a candidate is absent for the session where the investigation is carried out then they can be given the results of another candidate (but not teacher results). They will score zero for collecting data but can still access all other marks.

Candidates requiring the assistance of a scribe or amanuensis or with other access problems can receive help. For further details contact OCR.

There are a number of documents available to assist centre with the application and administration of these tasks.

- **The specification for Gateway Science**
- **Gateway Science Suite Guide to Controlled Assessment**
- **Exemplar tasks with marked candidate's work on the OCR website**
- **Candidate guidelines for controlled assessment** (section H of the guide to controlled assessment) also available separately from the website. These guidelines may be used by candidates in all parts of the controlled assessment.
- **The assessment criteria**. These may be given to candidates but the wording may **not** be simplified or changed in any way. Issuing the additional guidance to candidates is strictly forbidden.

Centres are thanked for the many hours of work put into running the assessments, marking the assessments and preparing the sample for submission. In the majority of Centres this work resulted in a moderation process which was accomplished without too much trouble.

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