OCR RECOGNISING ACHIEVEMENT

GCSE

Physics B

Gateway Science Suite

General Certificate of Secondary Education **J265**

OCR Report to Centres

January 2013

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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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OCR REPORT TO CENTRES

Overview

Centres have been exposed to not only the Sample Assessment materials for this new GCSE but also the B751/01 and B751/02 papers sat in January and June 2012. In this series, again only the unit 1 assessments were available (B751/01 and B751/02). There has been a noticeable shift in question techniques that OFQUAL had insisted on and this was evident for centres to see in these papers. Although they should now be less of a surprise it is worth summarising the main issues. As a result of this new approach the mean marks on the papers were lower than those from the legacy papers, but candidates gave good answers despite the challenges they faced. In many cases candidates were more prepared than in January 2012.

In these papers, candidates were expected to apply more in terms of **data handling** skills and the **application** of physics knowledge and understanding. **H**ow **S**cience **W**orks questions were more in evidence and these continue to leave many candidates wondering what to do. Candidates and centres are well advised to refer to the HSW statements at the front of the specification, as familiarity with the language alone may help them direct their answers better. The reports on the individual papers, along with their mark schemes, will help guide candidates and centres towards the desired expectations for success.

Prompting in longer questions with bullet points, which has proved very successful in the past, was largely absent on these papers. This led to answers that were often less focussed than in the past.

Calculation questions on the whole are being completed increasingly well. This is partly due to the formula being present on the paper. However, candidates do have to choose the correct formula and substitute the correct figures into it for 1 mark. The other mark is available for the correct answer. At higher level they may also be asked to rearrange formula. The usual errors are

- Missing decimal points from answers or calculations
- Not using or forgetting to bring a calculator
- Dividing the numbers the wrong way. Irrespective of the division it is tempting for candidates to put the smaller number underneath the line. So, for example, if the correct division is 3 / 6 which = 0.5 [2 marks], many will incorrectly divide 6 / 3 to get 2 [0 marks].
- Calculation questions are increasingly being asked where candidates choose numbers from a range of values. These questions may contain distracters in addition to what is really needed to answer the question. For example, a question to calculate acceleration given mass and force may also contain the distracters speed or energy. This makes the selection of the correct formula more demanding.
- Calculations are also increasingly being presented in developed form. In these developed questions, candidates are asked to do a calculation to prove an answer, or to comment on a response, or decide who is right. Often the maximum marks are only obtained when candidates refer to this developed aspect in the answer. It was pleasing though to see this happen regularly on both tiers. More frequently than has been the case in the past, some calculation questions were not attempted at all by candidates. If this was the first response in a line of questioning, it often resulted in no attempts at all. This is a pity as the general marking principle allows for errors carried forward. So if, for example, an error is made in part (i) of the question, it does not penalise later answers in part (ii), where a candidate could score full marks using the incorrect carried-forward value in a second correct calculation.

Six mark levels of response questions are being answered by candidates more confidently. They are still a significant challenge and a hurdle to some, but this time it was noticeable that candidates' answers increasingly responded to more parts of the question than in previous sittings.

Often candidates' answers will not fit in the designated area. A sensible approach used by many candidates is to indicate that part of their answer is elsewhere on the page. An arrow is often all that is needed to highlight this.

The Principal Examiners' reports which follow indicate good advice for teachers and candidates alike. Heads of Science are advised to use them with their colleagues so that in classroom situations they can routinely and purposefully advise their students.

B751/01 Unit 1 – Modules P1, P2, P3 (Foundation Tier)

General Comments

The overall performance of the candidates was satisfactory to good, although they often struggled with new approaches to assessment introduced in the new specification and examined for the first time in 2012. These were:

- the six mark level of response questions
- the questions targeted at 'How Science Works'
- questions that required a link to gain credit
- calculations that required some prior (Q.2b) or additional processing (Q6).

However, it should be noted that in all of these areas there were clear improvements since the June examination last year. Centres had clearly benefited from the experience of the 2012 examination and were able to better prepare their candidates for this paper.

Candidates are still finding it difficult to identify the level of detail required in the six mark questions and should guard against merely repeating information given in the question. This takes up answer space and vital time that then puts pressure on candidates to complete the answer adequately. Questions that require more than knowledge / recall (i.e. questions testing assessment objectives AO2 or AO3) proved problematic for some candidates; they must appreciate that applying their knowledge is essential to gain full credit in their responses.

The mean mark was 3 marks higher than in June last year, reflecting a slightly better performance on the paper.

Comments on Individual Questions

1 (a) The common error was to choose 'Sheep's wool', presumably because those candidates thought that the largest recommended thickness of insulating material would be best.

1 (b) Usually correct but reflecting light, absorbing, attracting or blocking IR or heat were poor answers given by some candidates. Heat or heat particles bouncing off the foil appeared in some answers.

2 (a) (i) The most frequently seen misconceptions were to only recall that the waves of the electromagnetic spectrum are 'fast', or to say that the speed increased or decreased. A small number referred to frequency, wavelength or properties. Some answers described differences between parts of the electromagnetic spectrum.

2 (a) (ii) Answers often contained two similar examples, e.g. two applications of IR imaging / photography. Mobile phone answers failed to mention the idea of a **short range** link for data transfer.

2 (a) (iii) A small minority of candidates gained both marks. Often the answers were about the avoidance of tangling wires or that a device can be '**taken**' anywhere. The convenience aspect of wireless technology was rarely adequately explained.

2 **(b)** Very few of the candidates calculated the wavelength correctly. The need to **determine** the wavelength from the diagram caused problems. Using 40 (answer = 10) or 10 (answer = 2.5) were common mistakes and resulted in a score of one mark. A small number divided the wavelength and frequency.

3 **(a)** Calculations were usually correct, but some correct answers failed to select the heater needed. Some candidates chose D but failed to recognise that D would not supply enough energy.

3 **(b)** **(i)** There was a low level of attainment in this question (only about 1/3 gained the mark). Incorrect answers stated that the temperature would rise. A smaller number of answers were centred on change of state.

3 **(b)** **(ii)** A very high number of candidates gained full credit. When errors did occur they were because of an attempt to convert 12g to kilograms or dividing the specific latent heat by the mass.

3 **(b)** **(iii)** The last part of question 2 was poorly answered, with two mark answers at a premium. Incorrect answers often concentrated on the ideas of the ethanol having a higher than expected boiling point. Other wrong answers were about the energy needed to cause a change of state or to break intermolecular bonds. Few responses appreciated that some energy would be used to heat the heater or container or that energy would be lost to the air.

4 The best answers quickly got to the point; the correct efficiency calculations were followed by reasons for the higher efficiency of heater A. Good answers that did not score 6 marks failed to justify the higher efficiency, whilst weaker answers merely gave some information about A and / or B without references to efficiency. Candidates should be aware that merely regurgitating information from the question will gain little or no credit. Few responses contained any mention of emissions from darker or lighter surfaces.

5(a)&(b) In (a), the idea that earthquakes **cause** tsunamis or that the earthquake happened under the sea, together with the idea of equipment, better positioning of 'sensors' or constant monitoring in the second part, usually secured both marks. In (b) a significant number thought that historical data could be used to predict the next event.

6 **(a)** Some candidates failed to get a foothold in this question; perhaps there looked to be a lot of information to digest. However, many good answers gained all three marks. Errors were

- multiplying 3 x 4 but not by the 15p
- dividing 3 by 4 then multiplying by 15p
- trying to use £1.72 in the calculation
- failing to answer the question about Alec's budget

The last point often occurred in answers that had the correct calculation.

6 **(b)** This was also well answered by the majority; 90% gained 2 or 3 marks. There were accurate calculations and, for most, a logical conclusion. Some correct calculations merely mentioned that Hovergold had a lower power, without mention of cost or the fact that the lower power would mean the mower would have to be used for longer, thus costing more.

7 This question was targeted at grades up to C and candidates often struggled to include sufficient detail about the absorption and penetrating power of alpha particles, beta particles and, in particular, gamma radiation. Often the penetrating powers were muddled, the appropriate absorber often being for another nuclear radiation. Most candidates totally neglected **safety,** despite the emboldening of the word in the question. When diagrams were offered as part of the answer, they were often unclear as to what penetrated or was stopped by what.

8 (a) A high number of candidates thought that workers would be safe working at 80cm, usually because they thought that the radiation count rate would be low, therefore safe. Some 'no' answers failed to justify this choice, with a low number actually appreciating that the count rate would still be in the range 20-30 and consequently dangerous.

8 (b) There was a poor level of knowledge of acceptable methods of low and high level radioactive waste disposal. Dumping at sea or storing in a laboratory / hospital / power station for low level and putting in box / in the ground for high level were common errors, whilst 'burning' was in some answers for both types of waste. The burying of high level waste was often part of an answer, without mention of **deep**.

9 (a) A small majority did not construct answers that were worthy of any credit. 'Craters' was the most frequent answer that gained one mark and 'species extinction' for the second mark when awarded. The third mark was very rarely gained; candidates came close but failed to hit the points in the mark scheme.

9(b)(i)&(ii) This was a How Science Works style of question and candidates often responded in non-scientific terms, e.g. taking precautions against asteroids in (i) and check results in (ii).

10 (a) Candidates were able to see the pattern in the increase in current and predict an answer in the allowed range.

10 (b) Around half of the entry then went on to summarise the increase of current with angle of the light beam correctly. Poorer answers were centred on the idea of more light on the photocell (with increasing angle), without relating this to the current.

10 (c) Many logically explained answers using 5 times the current values for one photocell were given by candidates. Answers that only mentioned larger area so more light (falling) on 5 photocells failed to score.

10 (d) The idea of facing or tracking the Sun was not greatly appreciated; putting it 'in' or at 90° to the Sun were recurring answers that did not quite answer the question.

11 (a) This question had a similar structure to 6a and 6b; similarly most candidates gave good answers through calculation and correctly rounding to 1 decimal place and, for many, a logical conclusion followed. Some were confused and tried to use the car's speed of 15.7 m/s in their calculation, whilst others started correctly (442 ÷ 26.1) and then could not do the division or rounding correctly. A few wrongly transcribed the height between the 101 floors from the diagram and failed to gain full marks. Some correct calculations were followed by the incorrect conclusion that the cars were faster than the lift.

11 (b) (i) The constant speed part of the graph was readily identified by most candidates. A to B was the most common incorrect choice.

11 (b) (ii) The idea of stopping (or to allow people in or out of the lift) was determined by many candidates, often for both parts of the graph. The idea of **longer** between F and G was rarely appreciated.

11 (c) (i) Approximately 80% of candidates gained credit in the calculation, although a significant number failed to appreciate the importance of '8 people' and gained only one mark for correctly computing 600 x 30 = 18000.

11 (c) (ii) A sizeable majority correctly identified that more work would be done in the second journey.

12 Although this was an overlap question, the standard of performance compared favourably with the earlier LoR questions (4 and 7). Weak answers simply restated information from the newspaper extract without developing what lay behind the claims. Better answers took the arguments forward, usually structuring a well-balanced argument for and against the increasing use of electric cars.

13(a)&(b) In the region of half of the entry were able to decide what was happening to the ball's speed from the graph. Those that did could therefore identify the forces required in part AB of the graph. Some candidates, on the right lines, reversed the correct forces in their answers. Poor answers gave energy (kinetic / potential) for forces.

13 (c) (i) BC was usually correctly chosen, with CD being the frequent incorrect selection. AB and DE were offered as answers less often.

13 (c) (ii) The concept of balanced forces (or named forces being equal) is difficult at Foundation level. Often answers restated the idea of constant speed or that the football could not travel any faster; others contained descriptions about gravity and energy 'balancing out'. Very few correct answers were given.

13 (d) Candidates can tackle this type of question more confidently. They can look at data and come to sensible conclusions based on their grasp of ideas in physics. The vast majority gained partial or full credit (almost 30% gained all 3 marks). Vague references to 'high' or 'heavy' reduced the potential mark in some responses. Crude calculations (i.e. using the idea of 'mgh' without conversion of mass and / or height to kilograms / metres) were credited since the use of GPE in Item h of Unit P3 is aimed at grade C and above and this question was targeted at grades E, F and G. Answers with calculations therefore did reflect the idea of Y having the greatest GPE by virtue of greatest mass and highest drop height.

14 Many candidates appreciated that crumple zones reduce injuries or absorb energy. Fewer mentioned the passive nature of the safety feature, i.e. that they only come into play in a **crash**. Crumple zones being designed to 'crumple / crush' or take the force of a crash were often in answers, or the idea of the crumple zones 'giving the driver more time to react'. Weak answers included the incorrect concept of the impact or force being absorbed, or that crumple zones change shape and protect the rest of the car. Some candidates misunderstood the question and wrote about ABS.

B751/02 Unit 1 – Modules P1, P2, P3 (Higher Tier)

General Comments

This was the second January session for this paper of the new Gateway Physics GCSE. Centres appear to be more aware of the changes to the specification, as the sample assessment materials and some past papers have been available for some time. As a result, centres will not have been surprised at the continuing changes in emphasis in some parts of this paper. There was a more rigorous expectation in terms of data handling, extended answers and applying knowledge and understanding. Also questions contained less scaffolding than those in the legacy assessment. Despite the changes and the different look and feel of this paper, candidates generally responded well. For instance there was a high attempt rate and relatively few answers were left blank. The paper, in most cases, seemed to fit in with the time allocated, but there was some evidence of answers being rushed or papers left unfinished. Most candidates were entered appropriately for this tier but, as always, there were some candidates who would have been more successful had they attempted the foundation paper instead. The mean on this 75 mark paper was 32 and the marks ranged from 1 to 69. Very few candidates, however, scored more than 60 marks.

Comments on individual questions

1 This question asked candidates to derive the wavelength from a diagram and then to use this value to calculate the current. About a third of candidates were able to do this correctly. Many failed to derive the correct wavelength but used the correct equation and gained [1].

2 This question was about specific and latent heat and involved calculations, some of which were developed.

2 (a) This question was answered successfully in several ways by 75% of candidates.

2 (b) (i) This latent heat calculation was also answered well by most candidates.

2 (b) (ii) Some candidates simply repeated the question here: eg. ‘Boiling’ or ‘turning liquid to gas’. Evaporation was also common [0], as was ‘change of state’ [0], but just over half of the answers could name another change of state [1].

3 This was a 6 mark level of response question about microwave cooking targeted up to A* grade. It was deliberately challenging, although good attempts were made by most candidates, with few non-attempts. High level answers (5 or 6 marks) were for answers that explained stirring, speed of cooking or standing time in terms of energy transfer. Also acceptable at this level was a good explanation of the fat or water particles gaining KE. At this level examiners were seeking to award 5 or 6 marks for any two of these explanations (about 15% managed to do this). Part answers were also credited at levels 1 and 2. Common misconceptions were that: ‘microwaves cook from the inside out’, ‘standing time needed to let the microwaves out’ and ‘standing time needed to let the food cool’ rather than allowing time for further conduction or convection.

4 This How Science Works question on ozone offered scoring opportunities for most.

4 (a) Most (70%) could pick one trend from the graph – eg. ‘Concentration reduces over the years’ [1]. A few went on to describe a further trend such as ‘the 10% line reduces less or not much’ [1], or ‘the range between the 10% and 90% line reduces over time’ [1]. About 10% scored both marks here by picking two trends in the data.

4 (b) Most candidates scored [1] here for the banning of CFCs. Often answers would be confused with global warming. Few though gave two answers or referred to people being more careful in the Sun [1].

4 (b) (i) Mostly correct.

4 (b) (ii) Most candidates referred to UV here [1]. Rather fewer used the idea of 'absorbing UV' [2]. Reflecting, filtering and attracting were words often used [0].

5 This question was about analogue and digital signals. Many candidates confused interference with noise in parts of this question.

5 (a) (i) Only about 40% scored [1] mark and 10% scored [2] marks. Marks were available for the idea that DAB uses multiplexing [1] so signals can be separated, or that the signals don't interfere [1].

5 (a) (ii) Interference and noise were often confused here.

5 (b) About half correctly referred to the different codes for each button on the handset. [1].

6 This question was about photocells. There was some evidence of candidates failing to act on the command word **explain**. This led to some confusing responses.

6 (a) (i) The first part was about using a graph plot to estimate the current at 30cm. Most candidates gained [2] here for 24cm (20-28cm). Those failing to fall into this range of +/-4 gained [1] for the correct plotting of the points.

6 (a) (ii) Most candidates could describe the basic trend [1], e.g. current reduces as distance increases [1]. Some were vague in describing current as weak or strong, slow or fast [0]. Better answers (less than 10%) went on to explain that as distance doubled the output quartered [2].

6 (a) (iii) Most candidates could explain the trend here.

6 (b) Half of answers failed to score here when attempting to describe how a solar cell works. Marks were available for electrons are knocked free [1] from silicon [1] atoms, resulting in a flow or movement of electrons [1] (around the circuit).

7 This question was about household electricity. The calculation, being of a developed nature, was not as straight forward as others in the past.

7 (a) In this calculation half of the answers failed to gain a mark. About a third correctly calculated 52p [3], but the remainder got lost in the figures and factors of 10. However, many candidates gained marks for partially correct working.

7 (b) A third of candidates were correct with 0.69 (kW) [2], but over half failed to correctly convert the answer into kW and gave 690. This answer gained [1] as it was partially correct.

7 (c) About 30% gave the idea of inconvenience [1].

8 This was a 6 mark level of response question about transformers and the National Grid targeted up to A* grade. It was deliberately challenging, although good attempts were made by most candidates, with few non-attempts. High level answers (5 or 6 marks) were for answers that explained that the transformers reduced the current, temperatures and heat loss in the wires, thus reducing energy losses. Level 2 answers (3 or 4 marks) related to the voltages needing to be high to reduce energy loss. Level 1 answers (1 or 2 marks) generally described the transformers as step-up and step down. 40% of candidates failed to score and generally only grade A* candidates successfully navigated the Level 3 physics required here. The question differentiated very well.

9 This question about space discoveries was also covering the How Science Works aspects of the specification. Many candidates seemed unfamiliar with the developing theories of the Solar System.

9 (a) (i) About 40% or so stated that he used models [1] or astronomical observations [1]. Many merely repeated information in the table.

9 (a) (ii) Again less than half of candidates got this right. Those that did usually referred to an improved telescope being used or invented.

9 (a) (iii) Just over half knew that the influence of the Church was responsible here.

9 (b) This question about the Big Bang theory uncovered the usual misconceptions about it. Frequent ideas seen were that galaxies / stars / planets / moon were expanding. Many though (50%) knew that galaxies were moving apart [1] and some (only about 10%) went on to say that the outer ones moved faster than the inner ones [1].

9 (c) This was mostly correct.

10 This question was about motion and involved graph work and calculations.

10 (a) Very few scored [3] here for the answer 10m/s **and** that Sam is wrong. Most calculated the answer as 5m/s and that Sam was correct [2]. As usual this and other errors were credited fully if taken forward correctly into subsequent parts (ecf).

10 (b) Most candidates scored [1] here by describing acceleration and deceleration for the parts. Some gained [2] for comparing the times for each section or calculating the accelerations correctly.

10 (c) (i) About a quarter gained [2] marks here for calculating the power.

10 (c) (ii) Most candidates could not answer this question. About 20% calculated it correctly [1] and a further 20% went on to display the correct answer (1100) to 2 significant figures [2].

11 This was a 6 mark question about the introduction of electric cars, which was common with the foundation paper. It was targeted at grades C and D. Many answers simply repeated the statements from the list in the question. So, for example, electric cars have no emissions [0] but electric cars do give out CO_2 where they are used [1]. At Level 1 we were looking for pros or cons. Level 2 required both pros and cons and two of each at least were needed for credit at Level 3.

12 This question about parachuting was quite well answered on the whole.

12 (a) This part effectively asked candidates to describe and explain the parts of the fall. For full marks each section needed to be described correctly and explained, e.g. part A shows acceleration and the weight is greater than the drag [1]. Some only referred to the descriptions, e.g. A is accelerating and B is terminal velocity [1]. Many answers fell short in their descriptions by using vague terms such as 'gravity' for weight or 'upthrust' for drag.

12 (b) Although this was an objective question it remained high demand. 10% gained all marks here. Some candidates ticked but did not cross in the boxes. Blank boxes were ignored by examiners. Most candidates gained [1] or [2] marks here.

13 This question on thinking and braking distances differentiated very well. Candidates had to explain the effects on thinking and braking distances when the speed doubled on a wet road. Many answers were vague and unstructured. 'Time' was often used rather than distance and many failed to say if distances were **increasing** or decreasing; 'braking distance is **affected**' was common.

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