RECOGNISING ACHIEVEMENT

GCSE

Physics B

Gateway Science Suite

General Certificate of Secondary Education **J645**

OCR Report to Centres

January 2012

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Oxford Cambridge and RSA Examinations

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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.

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OCR REPORT TO CENTRES

Overview

Several examination sessions for these papers have been set now, and centres are clearly using past papers to prepare their candidates thoroughly. Some candidates also will be accessing the papers directly from the OCR website which is admirable. As a result generally the standard of answers continues to improve. Also the understanding needed to answer many questions has become more secure with more candidates. Whilst the contexts of questions do change, the science within them is largely from specification statements – and so that remains the same. Sometimes though, the contexts can disorientate candidates as they try to apply their knowledge and understanding to an unfamiliar context. This is more often seen in higher demand questions. Although this is still the case candidates seem to be getting more confident at applying knowledge in these ways. This trend of applying knowledge in different contexts, particularly in unfamiliar ones, is likely to continue. In fact, this along with some other elements of assessment (new to the new Gateway specifications), have changed slightly in their emphases on these legacy papers. This will help centres in their adjustment to the new Gateway approach.

There are still a few common issues that it is worth reminding centres about.

There will be up to 15 marks available on a paper (60 marks) for **short prompted responses**. These are often 'choose from a list' type questions. Usually it is the case that they are almost always attempted. The distracters in these papers are usually devised to test knowledge rather than to 'catch-out' candidates. Sometimes two answers are asked for but often only one response is given. Also occasionally the answer is left blank, probably as there is no answer line. At the end of the exam it is a good idea for candidates to use any remaining time to check for such omissions. These types of question are not always targeted at the lower grades on a paper. For example questions on star cycles or P and S waves can often follow this format and yet still remain firmly in the higher demand part of the specification.

Calculation questions as a rule are being completed increasingly well. This is partly due to the formula being present on the paper. However they do have to choose the correct formula and substitute the correct figures into it for 1 mark. The other mark is available for the correct answer. At higher level they may be asked to rearrange formulae too. The usual errors are missing decimal points from one of the input values (eg 15V rather than 1.5V).

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, many will incorrectly divide 6 / 3 to get 2.

Calculations 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 correct formulae more demanding.

Calculations are also increasingly being presented in developed form. In these cases, candidates are asked to do a calculation to prove an answer, or to comment on a response, or decide who is right.

Centres should remind candidates that scripts are scanned as black and white images, so the use of coloured pens or faint pencil is not recommended. Also often candidates' answers will not fit in the designated area.

A sensible approach used by many candidates is to indicate part of the answer is elsewhere on the page. An arrow is often all that is needed to highlight this. This will then direct the marker to open up the whole page and mark accordingly. If no such indication is there then the answer may be missed.

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.

B651/01 Unit 1 – Modules P1, P2, P3 (Foundation Tier)

General Comments

This was a small entry paper with approximately 530 candidates. No candidate scored above 53 and at the other end of the spectrum only 4 candidates scored less than 15. All questions scored and there were no "dead" marks. Candidates should be reminded to show all their working in calculations as there are working marks that can be awarded when an arithmetic error occurs in the final answer. The questions were clear and there was no evidence that candidates did not understand what was required of them. No incomplete scripts were viewed indicating that there were no time constraints on the candidates.

Question 1

(a) The majority of candidates were able to identify the correct unit for temperature.

(b) Most of the candidates were able to write about one thing that would produce a different temperature rise. This was usually about using a different volume of water. Few candidates referred to different liquids or different room temperature. Candidates found it difficult to write about a second thing and often changed the examples that were kept constant in the question; use a different heater or beaker and use a different starting temperature.

Question 2

(a) For part (i) two bullet points were provided to assist candidates in their answers to this question and they were used well, with the majority of candidates providing answers to both points. Nearly half of the candidates were able to explain which part of the bread was toasted and a further third, how the shiny sides reflect the infrared radiation. For part (ii) approximately half of the candidates were able to give one other use of infrared radiation. This was usually identifying the use of infrared radiation in television remote controls.

(b) Less than half of the candidates were able to calculate the efficiency of the heating elements. A few of these candidates attempted to add a unit such as J to their answer. The majority of the candidates gave the correct answer as 0.75 with a few correctly converting the efficiency to a percentage. A considerable number of candidates divided the smaller number by the larger number resulting in an answer of 1.33.

(c) Almost half of the candidates were able to write down two things that use trapped air to keep houses warmer. The most common answers were cavity wall insulation, loft insulation and double glazing. A few candidates were not specific enough with answers such as windows and lofts.

Question 3

(a) All candidates attempted this question and the majority of candidates were able to identify how ultraviolet radiation can harm people. Good answers included a list as well as descriptions of the harm. This was pleasing to see on a Foundation paper.

(b) In part (i) about a half of the candidates gave the correct answer to this question as 105 minutes. The candidates who did not achieve a mark, usually did not use the information about the safe time in the sun from the table and gave an incorrect answer of 15 minutes. Just over half of the candidates correctly calculated the longer time with an SPF of 45 for part (ii). Examiners used error carried forward from part (i).

Question 4

(a) The majority of candidates were able to write down an advantage of using wireless communications. This usually involved describing how portable wireless devices could be used.

(b) In part (i) most candidates correctly identified analogue from the list but in part (ii) only half were able to recognise a digital signal. The sinusoidal wave A was often incorrectly quoted.

(c) Candidates found this question about how signals get from the dish to the receiver difficult even though they were provided with a list to choose from. Many candidates gave refraction as their answer.

Question 5

(a) Few candidates knew that EM waves all travel at the same speed and many thought that sound waves travel faster than EM waves.

(b) The majority of candidates were able to recognise the amplitude on a transverse wave diagram.

(c) Most candidates were able to describe how the use of light signals made communications quicker.

Question 6

(a) This question was answered particularly well compared to a similar question in June 2011. The majority of candidates were able to correctly identify the need for oxygen, food and water to keep the astronauts alive in the Space Station.

(b) Most candidates were able to write down one use of an artificial satellite but only half could correctly write down two uses. The most common correct uses included mobile phone communication, weather forecasting and GPS.

Question 7

(a) Most candidates were able to recognise that beta radiation is used for thickness testing for paper but fewer knew that alpha is used in smoke alarms or gamma is used in sterilising medical equipment.

(b) Few candidates were able to write down a source of background radiation. Many candidates did not read the question carefully and gave the names of living things as their answer. Rocks was a common correct answer with very few candidates appreciating the contribution made to background radiation by nuclear testing, nuclear bombs or cosmic radiation.

(c) The majority of candidates answered correctly with a few not able to suggest a second or third safety precaution. The common answers were protective clothing and masks.

Question 8

(a) The majority of the candidates correctly identified the shower and gave the reason it costs the most to use as having the largest power in kW. A few candidates did not use the information provided in the table and the question and thought the reason the shower cost the most to use was because it provided hot water or was switched on for a long time.

(b) Over half of the candidates identified the red kettle as being the one which costs the most because it was switched on for the longest time. A significant number of candidates thought it was the red kettle because it took the longest time to switch on or that it was the best colour to absorb or reflect heat. Again, candidates should be reminded to use the information provided in the question and in the table.

(c) Candidates found this calculation about the cost of using the shower difficult. Few candidates achieved all three marks available. A common error was to only multiply the time and the power together and forget about the cost of electricity for a kilowatt-hour unit. Those candidates that had shown their working still managed to achieve one or two marks for their answer.

Question 9

This question involved completing sentences. Few achieved all four marks available. Most candidates correctly identified that a larger surface area produces more power than one with a smaller surface area. Significantly fewer knew that photocells transfer light energy into electricity. That photocells produce direct current was the most difficult answer for candidates.

Question 10

(a) The majority of candidates correctly named the equipment in part (ii) used to measure distance and time. In part (i) nearly all candidates calculated the average speed of a bowling ball correctly.

(b) Most candidates correctly identified acceleration in part (i) and greater deceleration in part (ii) from the speed time graph in the question.

Question 11

(a) In part (i) most candidates were able to identify a fossil fuel as petrol or diesel. A number of candidates thought that the truck could use (crude) oil directly. In part (ii) the majority of candidates knew that the type of energy because of movement was kinetic energy.

(b) Nearly all candidates were able to identify the calculated driving force for part (i) and the calculated work done for part (ii) from the list of numbers given to them.

(c) Most candidates were able to complete the sentence to describe braking distance. Slightly fewer were able to complete the sentence to describe thinking distance.

(d) In part (i) the majority of candidates identified either airbag or crumple zones as being part of a vehicle designed to absorb energy in a crash. Few candidates described why seat belts need to be replaced after a crash. The vast majority gave vague answers about the seatbelts being damaged. Examiners were looking for the idea that the seatbelts have been stretched.

Question 12

Two bullet points were provided to assist candidates in their answers to this question but candidates tended to just use the words downward force and upward force without describing or naming the forces involved. Most candidates appreciated that gravity was involved but fewer candidates referred to an upward resistive force. Many candidates did appreciate that the area of A was larger than the area of B but gave muddled answers when trying to describe why the crushed up paper case falls faster than the uncrushed one. A number of candidates thought that crushing a paper case makes it increase in weight.

Question 13

(a) Less than half of the candidates correctly gave the answer of force and distance. Many thought that doing work involved power or speed.

(b) In part (i) few candidates identified gravitational potential energy as increasing when jumping over the bar. The majority of candidates gave the answer kinetic energy. In part (ii) about a third of candidates appreciated a factor that could increase either potential or kinetic energy. The height of the runner was a common correct answer but many incorrectly thought that the runner was less heavy.

B651/02 Unit 1 – Modules P1, P2, P3 (Higher Tier)

General Comments

The candidates performed very well throughout the paper displaying good levels of knowledge and understanding together with appropriate mathematical skills in all three sections of the paper. Straightforward calculations were handled with ease but staged calculations were not tackled with any degree of confidence.

Similarly, in questions where the answer was straightforward, such as 2(a), candidates performed much better than in questions where they had to apply their knowledge to a new situation, such as 8(b) and 12(a).

However, the general level of performance reflected the fact that most candidates commanded a broad grasp of fundamental physics and had been well prepared for the examination by Centres.

Comments on Individual Questions

SECTION A

1 This initial calculation showed a high level of differentiation. The most able candidates calculated 70^0C with ease but others either could not rearrange the specific heat capacity formula correctly or failed to add 20^0C to their calculated temperature rise. One and two mark answers were almost invariably due to not being consistent with the units used in the calculation.

2 **(a)** **(i)** Candidates displayed a sound level of understanding about infrared being reflected from the shiny sides of the toaster and heating or toasting the surface of the bread. Only a tiny number failed to gain some credit in their answer.

(ii) This calculation was handled confidently by the vast majority. When errors were made the ratio of lost energy to heat taken in by the toast or the inverse of the correct ratio was calculated. Occasionally a mark was lost because the final answer was wrongly expressed eg 75 (no % sign) or 0.75% or 0.75J.

(b) Microwave cooking always presents difficulties to candidates when they try to construct an answer.

Some have the misconception that the microwaves cook from the inside out or reach the centre whilst a more common error is to completely neglect to use the ideas of water or fat molecules gaining **kinetic energy** and molecules or particles then **passing on** kinetic energy.

3 **(a)** **(i)&(ii)** Usually correct in the first part and carried through to the second with answers numerically correct or the recognition of 'three times longer'. Some wrong answers in (i) were correctly carried forward to (ii) eg 30 min. in (i) then 60 min (longer) in (ii). A small number thought that it would be 45 times longer in (ii) ie they quoted the SPF for the 'COOL TAN ' cream.

(b) Although this was an unprompted objective question it gave a good level of differentiation illustrating that such questions are not necessarily easy. The usual errors were; weaker or damaged in the second response and greenhouse or harmful gases in the third. Some candidates gave CFC's and greenhouse gases in the third part, Centres should make sure that candidates are aware that a right and a wrong answer will gain no credit.

4 **(a)** Although candidates often find it difficult to express ideas about analogue and digital signals the vast majority gained one or two marks. When only one answer gained credit it was usually for an on/off, 0/1 description of a digital signal. Candidates should be aware that saying 'it varies' for analogue is insufficient; both signals vary.

(b) Approximately half gave the expected answer (usually similar or same frequency rather than wavelength). There were some good descriptions of overlapping waves (overlapping was in the question) describing what interference is and this was the usual error when no mark was scored.

(c) Half the answers given were correct; bounce or diffract in the first part and an incorrect region of the (upper) atmosphere in the second causing the failure to gain credit.

(d) **(i)** A low success rate considering that this is a standard demand idea. Half the wavelength (3cm) and 4cm (presumably from adding the amplitude values) were the usual errors.

(ii) When asked for description candidates often fall short with their explanation when testing their understanding of frequency. This style of asking the question was far more accessible. On the surface a more complex idea than wavelength but far more gained this mark than in part (i).

SECTION B

5 **(a)** A relatively easy question which most scored both marks and very few failed to score. When only one mark was gained the gamma use was usually correct with the correct beta and alpha answers reversed.

(b) A rather low success rate, food, the Sun, mobile phones and the Big Bang/microwaves being the incorrect physics in answers.

(c) **(i)** Uranium was widely known by the candidates although plutonium was sometimes repeated or a named fossil fuel was given when candidates had missed or ignored **nuclear** in the question.

(ii) Similar to 5(b), there were some poor answers with 'bombs' and 'weapons' lacking the word nuclear (or atomic). Some answers merely repeated the thrust of the question answering along the line of 'a fuel'.

(d) A higher than expected level of differentiation in this question. Answers were often in the right area but were too vague:

- pollution given without reference to greenhouse gases (advantage)
- problems of dealing with waste were not keyed to **nuclear** waste (disadvantage)
- causes problems for a (very) long time not specifying **radioactive** or long half life (disadvantage)
- nuclear power is more efficient or power station are expensive to build.

6 This question was designed to achieve a high level of differentiation (high demand material on the syllabus) and it succeeded, with comparable numbers gaining 3, 2, 1 and zero marks. There were often omissions rather than errors (eg failing to say the electrons were 'knocked' off or not referring to from silicon (atoms) or even the photocell for the first point or just saying direct current travels straight to where it is needed for the direct current part of the answer). A common misconception for the definition of DC is that the electrons travel directly to the point of use. Very few confused the photocell with solar heating panels.

7 **(a)** The vast majority of candidates gained credit with slightly above half calculating the correct answer and scoring full marks. This type of calculation does not really follow a formula approach and weaker candidates find the intuitive nature of solving them difficult. The usual mistake was to do a partial calculation such as 7 x 0.2 (to give kWh and neglect to multiply by the unit cost) or to do 7 x 12 (forgetting to include the time of use). Occasionally seen was: 7 x 0.2 x 12 x 0.2, presumably because the time was emphasised twice in the question and this confused some candidates into thinking it needed to be used twice.

(b) A large majority gained at least one mark, usually for the idea of costing less/saving money.

The disadvantages were not so well known, or expressed. Failing to specify inconvenient **night-time** use or the dangers from **unattended** appliances often left the second mark unsecured. Ideas about additional wiring/meter, need for timers or an extra standing charge (probably some of the most important points to stress in teaching) were very rarely seen.

8 **(a)** **(i)** A straightforward calculation that most calculated correctly for two marks, one mark responses were rare. When no marks were awarded the error was to subtract 40 MJ from 80MJ rather than using the efficiency equation.

(ii) Since (a) (i) was usually correct candidates followed on to successfully add their answer to 40MJ and subtract the sum from 120MJ. More often than not if the earlier answer was incorrect candidates correctly carried their error forward.

(b) A challenging question where use of data and an explanation were both required to gain credit.

Weaker answers only stated the value or % that was either useful or wasted and neglected to give a figure for the energy used to heat homes and/or schools. Answers that gained no marks either just quoted figures or were only prose with no data included.

SECTION C

9 **(a)** Almost universal success with this first calculation in Section C.

(b) **(i)&(ii)** A very high (ie > 80%) level of attainment in both parts, slightly higher in the second part.

There were no regularly repeated choices for incorrect answers.

(iii) For a one mark question this proved to be quite difficult. Many candidates responded with 'time', 'speed, or 'acceleration' which led to a surprisingly high level of differentiation.

10 **(a)** Three quarters of the entry gained one or both marks, the one mark answer was often 'mass or weight and velocity or speed', the candidates neglected to specify that the quantities should be higher or increased.

(b) **(i)&(ii)** The calculations were very well done. Calculations without the objective help would probably have shown a much lower level of accessibility; a clear case of a little help enabling the candidates to display the physics that they had a grasp of.

(c) Good attainment, similar (or even better) than in (b) but as in (a) not specifying correctly sometimes cost a mark eg:

thinking distance:
- if alcohol had been consumed **or not**
- more concentration
- mobile phones.

braking distance:
- weight in the truck
- poor or bad weather
- road surface.

(d) Most gained the mark for the idea of Samuel driving faster or accelerating and/or braking more often.

11 This was another question with an appropriate level of differentiation. Most candidates correctly identified seat belts and went on to write about increased collision time. Fewer went on to relate this to a lower deceleration (lower rate of change of momentum was hardly ever given as an answer); often they just restated the lower force idea given in the question. Answers that did not gain any credit merely restated the reduction of the force and that seat belts stop people hitting the dashboard or windscreen. True, but lacking a scientific explanation.

12 **(a)** There were some good answers relating surface area to drag and the better answers went on to relate this to the higher or lower terminal speed. Failing to specify surface area only mentioning shape or size often reduced the potential mark. Only the very best candidates appreciated the need to explain how A and/or B reached a terminal speed most failed to mention that drag increased with speed or at terminal speed weight and drag balance. There were too many answers that stated that gravity became balanced, or gravity balanced speed or energy.

(b) This area of the syllabus is a difficult one to grasp; the drop in GPE not causing any further increase in kinetic energy does not sit comfortably with candidates ideas about energy transfer. This was aimed at the top grade and the question performed as expected.

13 The final calculation differentiated better than some earlier calculations. The rearranging of the GPE formula found many out, they neglected to divide the GPE by mass **and** 'g', often dividing by one or the other. Poorer efforts put the fraction the wrong way around.

B652/01 Unit 2 – Modules P4, P5, P6 (Foundation Tier)

General Comments

This was a very small entry paper with approximately 120 candidates. No candidate scored above 45 and at the other end of the spectrum only 5 candidates scored less than 18. Candidates should be reminded to show all their working in calculations as there are working marks that can be awarded when an arithmetic error occurs in the final answer. This was particularly important for questions 9(c) and 9(d). No incomplete scripts were viewed indicating that there were no time constraints on the candidates.

Question 1

(a) In part (i) of this question candidates were asked to choose which wire is colour coded blue from earth, live and neutral. The majority of candidates answered correctly but a number of candidates selected live as their answer. Candidates were more familiar with the answer to part (ii) being the earth wire colour coded green and yellow. Candidates found part (iii) much more difficult with only about a third giving the correct job of a fuse. The Examiners were looking for the idea that a fuse is used for safety reasons but many candidates thought a fuse switches the power on and off or controls the current flowing in the appliance. A few higher level answers were seen where candidates correctly described the fuse blowing when there is too much current.

(b) The majority of candidates correctly identified the live and neutral wires as being connected to the double insulated games console.

Question 2

(a) In part (i) very few candidates achieved the mark for completing the sentence about the measurement of the activity of a radioactive source. Examiners were looking for decays per second or emissions, counts or disintegrations per second. Many candidates thought that activity was measured in radioactivity per second, metres per second or speed per second. Nearly all candidates were able to describe that the activity reduces over time for part (ii).

(b) Two bullet points were provided to assist candidates in their answers to this question and they were used well with most achieving one or two marks for this question. Most candidates wrote clear explanations and wrote about how nuclear radiation can be used to treat cancer by killing the cancer cells. Some candidates tried to give a list of what can be treated including how kidney stones could be broken down and so only achieved one mark for the treatment of cancer if this was included in their list.

(c) The majority of candidates correctly explained how high dose gamma radiation is used to sterilise equipment by killing bacteria. There were far fewer references to gamma merely being used for cleaning the equipment than in previous years.

Question 3

(a) Nearly all candidates correctly completed the bar chart, the other candidates left the bar chart blank.

(b) In part (i) fewer than half the candidates were able to write down the name of a nuclear fuel. Many candidates gave the name of a nuclear fuel as coal or gas. Candidates found part (ii) of this question about the chain reaction and how the release of heat is used to heat the water difficult. Very few were able to name the reaction and those that did achieve marks tended to explain how the heat is used to make the water boil or produce steam to turn the turbines.

(c) Very few candidates knew that materials are placed in the reactor to make them radioactive. Most candidates did attempt the question but tended to give vague answers such as put them near to some radioactivity or add something to them.

Question 4

(a) Few candidates were able to write down the meaning of frequency in terms of waves or ultrasound. Examiners were looking for waves or vibrations per second or per unit time. Many wrote about the general meaning of the word frequency and gave vague answers including how often something happens and happens a lot.

(b) The majority of the candidates wrote down a use for ultrasound in hospitals. The most common correct answer was for pregnancy scanning although many candidates also correctly wrote about its use in breaking kidney stones.

Question 5

(a) In part (i) over half of the candidates achieved one mark for correctly describing that the doctor places the charged paddles on the chest to restart the patient's heart. A surprisingly large number of candidates thought the paddles should be placed directly onto the heart or just rubbing the paddles together would be sufficient. Few candidates appreciated the need for good electrical contact to ensure the charge reaches the heart. In part (ii) the Examiners were looking for the heart muscle contracts when the charge passes through but few candidates gave this as their answer. Most tended to write about the heart being shocked or to start and stop the heart beating.

(b) About a quarter of the candidates were able to describe a situation where static electricity is dangerous. Good answers included lightning and the risk of an explosion when refueling a car or plane. Many candidates only described situations where static electricity is a nuisance such as clothing clinging and minor static electricity shocks when you touch something.

Question 6

(a) The majority of candidates correctly identified the Moon as Earth's natural satellite.

(b) In part (i) nearly all candidates identified gravity as the force that holds artificial satellites in orbit. In part (ii) candidates were asked for a use of an artificial satellite and again nearly all candidates were able to achieve this mark. Many candidates wrote answers with clear descriptions of uses of communication for mobile phones signals and satellite television signals.

Question 7

(a) In part (i) most candidates were able to suggest one way the radio waves get to the receiver but found it difficult to suggest a second way. Examiners were looking for the radio signals being spread around the mountain and reflected from the atmosphere. Where candidates had used the idea of diffraction or reflecting from the ionosphere the Examiners awarded two marks. In part (ii) the majority of candidates correctly identified the aerial as being the part of the radio that receives radio signals. Similarly in part (iii) the majority of candidates could identify the need for a satellite dish to receive satellite signals.

(b) Just over half of the candidates were able to appreciate that the wavelength of radio waves are longer than the wavelength of microwaves. A number of candidates thought they had the same wavelengths.

Question 8

(a) In part (i) only a third of the candidates were able to complete the ray diagram for the convex lens. A few candidates did not draw the rays crossing at the focal point but most candidates either added lines that were diverging or left the ray diagram blank. Many more candidates were able to choose the correct letters to complete the sentence to describe the focal length of he lens in part (ii). They also appreciated that the focal length would increase if a thinner lens was used in part (iii).

(b) The majority of candidates were able to name a device that uses a convex lens with the camera and glasses being the most common answers. Fewer candidates were able to name the type of image or describe where the image is produced. Many thought the image was enlarged by a camera or the image was focused on the lens in the eye when glasses were worn.

Question 9

(a) The majority of candidates were able to explain that the relative speed increases and some candidates also calculated the relative speed correctly.

(b) Most candidates correctly calculated the momentum of Dave and his bike. The other candidates tended to calculate just the momentum of Dave or just the bike.

(c) Candidates found this calculation of Dave's final speed difficult. A number of candidates selected the correct equation from page 2 as v = u + at but substituted incorrectly. Candidates tended to write the substitution as 12 + 0.5 x 5 rather than 12 + (0.5 x 5) and so calculated their answer as 62.5 m/s rather than the correct answer of 14.5 m/s.

(d) Candidates also found the calculation of distance travelled difficult and many failed to attempt the question. Those that did selected the correct equation from page 2 but did not appreciate that the value of u was 15 m/s and the value of v was 33 m/s.

Question 10

(a) In part (i) nearly all candidates correctly identified the symbol that represents a switch and in part (ii) most were able to identify the symbol that represents a variable resistor.

(b) Candidates found the calculation of resistance straightforward and the majority achieved two marks.

(c) Just less than half of the candidates correctly choose the value of 35Ω to show they understood that resistance increases when the wire is hot. A significant number thought that the resistance would decrease and so gave the lowest answer, 15Ω, from the list.

Question 11

(a) In part (i) only a few candidates were able to identify the letter S as the output for the whole system with many choosing P the output from the OR gate. In part (ii) approximately 80% of candidates where able to complete the sentence to explain that the LDR responds to change in light intensity but only 40% of candidates knew that a thermistor responds to changes in temperature.

(b) In part (i) the majority of candidates completed the sentence to describe the input signal to a logic gate as being a high or low voltage. The majority of the candidates were also able to compete the sentences about a NOT gate for part (ii) using the words high and low correctly.

(c) In part (i) few candidates were able to write down the name of a component that keeps the buzzer sounding once it is triggered. Many wrote down switch of battery as their answer. Even fewer candidates were able to recognise the description or symbol for a relay in part (ii).

Question 12

This question was about capacitors and what happens when the circuit containing a capacitor is switched on. Candidates were prompted to include ideas about charge and voltage. About half of the candidates correctly described how charge moves around the circuit or builds up on the capacitor. There were some good descriptions of the process seen in the answers of candidates that achieved two marks for this question. However, few candidates explained that voltage across the capacitor increases.

Question 13

(a) In part (i) half of the candidates correctly identified isolating as the type of transformer used in a bathroom shaver socket. Fewer candidates were able to explain how this type of transformer makes the circuit safer in part (ii). Examiners were looking for the idea that the shaver was not connected to the mains or that there was a reduced risk of electrocution. Many candidates thought that the isolating transformer stopped water reaching the wires of that it switched off when water touched it.

(b) In part (i) the majority of candidates were able to write down the name of an appliance in the home that has an electric motor with tumble dryer and food processor being the most common answers. Very few candidates were able to give the answer generator or dynamo for part (ii).

B652/02 Unit 2 – Modules P4, P5, P6 (Higher Tier)

General Comments

Overall, the paper produced a good spread of marks, ranging from 54 to 3, from the 1260 candidates. The mean mark for the paper was 29.8. There was some evidence that candidates had been entered inappropriately.

Candidates seemed to have sufficient time to answer the questions and all questions appeared to be accessible to the candidates. Only questions 12 and 13(c) had omission rates above 10%.

The majority of candidates were able to answer calculation questions correctly. Only question 6(c) proved more demanding.

The paper discriminated well over the target grade range A* to C and candidates were given adequate opportunities to demonstrate what they knew and understood.

There were a few instances where candidates' handwriting and spelling made the award of a mark difficult. Question 3(a), for example, provided words which read as fussion.

Comments on Individual Questions

1 Most candidates realised that the doctor placed paddles on a patient's chest but some suggested placing them directly onto the heart. Many candidates failed to address the second element of the question regarding good electrical contact. Only a third of candidates correctly stated that the heart contracts when the charge passes through it. Many provided vague answers suggesting the heart restarted. The dangers of static electricity are generally well known, although a number of candidates provided general answers regarding the dangers of touching live cables. The principles of using electrostatics in paint spraying appear to be well understood.

2 Only half the candidates correctly explained the meaning of frequency. Some candidates described wavelength and some speed. Others explained the meaning of ultrasound. Most could name a use of ultrasound although some descriptions were too vague. There is a difference between looking inside the body and looking at an image of the inside of the body.

3 The majority of candidates correctly identified the process as fission. Some suggested fusion and others simply a nuclear reaction. The stages in the generation of electricity are almost universally well known.

4 Whilst the majority of candidates correctly calculated the current in the lamp, explanations for using the 5A fuse were often confused. Many believe that the higher rated fuse would encourage an increased current.

5 A greater number of candidates were familiar with the process of alpha decay than beta decay. $^{14}_{6}C$ was a common answer. Just over half the candidates correctly calculated the time for decay. All other answers were seen. There is confusion about the meaning of tracer. Many referred to the tracer being moved above ground and detecting the radiation.

6 The first two calculations did not prove to be difficult for the candidates. However, the last calculation was performed by many candidates as 15+(33x12/2).

7 Two thirds of candidates could identify one way in which a signal could be received, usually by diffraction. Reflection from the ionosphere is not so well known and many suggested reflecting from satellites. A small minority believe the radio signal would be transmitted through the mountain. Only a small minority of candidates could suggest why the signal from a higher frequency is weaker. Many thought the frequency was lower or that the signal was weaker. The most common correct response was through absorption or scattering by dust or rain. The labelling of the interference diagram did leave a lot to be desired. Candidates were asked to **clearly** mark a point. Many wrote the letter somewhere near to the points of constructive or destructive interference. Those who did make their intentions clear, usually scored the mark for constructive interference but identified destructive interference as the intersection of two troughs.

8 This question discriminated well. More candidates referred to the differences in refractive index than differences in speed within the glass prism. There were no common misconceptions.

9 There were few good answers to this question. Many candidates referred to the forces on the car and barrier as large or small and their directions as in the direction the car was travelling. Most of the candidates acknowledged that the collision time increases with the improved crumple zone but could not then link this to the rate of change of momentum. Many wrote of the momentum decreasing or being conserved.

10 Most candidates were awarded four or five marks but many failed to realise that resistance is the **reciprocal** of the current-voltage graph.

11 The majority of candidates linked the resistance of the LDR to the temperature instead of the light intensity. Half the candidates were awarded at least one mark for the truth table but those who scored both marks found it difficult to explain how this warned of a problem in the greenhouse. Many omitted to state that the power supply had to be on. The potential divider is not well understood. Two thirds of candidates failed to score a mark. Only a small minority mentioned temperature as the last entry.

12 Most candidates knew that charge flowed in the circuit and some that the voltage increased. Many went on to discuss the effect of a capacitor in an AC circuit and the resultant smoothing effect.

13 Although the majority of candidates knew that an isolating transformer is used as a shaver socket, explanations for its use were very varied. Many described its construction and why the output voltage is the same. The sequencing of the action of a transformer proved to be difficult for many. The last two stages are better known than the first two. Only 5% of candidates knew the reason for curved poles on the magnet of a motor. Most argued that it made the motor spin faster. Some suggested it produced a bigger current.

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