

Examiners' Reports

January 2011

J645/R/11J

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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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General Certificate of Secondary Education

Gateway Physics B (J645)

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Chief Examiner's Report

Several examination sessions for these papers have been set now, and centres are clearly using past papers to prepare their candidates thoroughly. As a result generally the standard of answers continues to improve. Also the understanding needed to answer many questions has become more secure. Candidates seem to be getting more confident at applying knowledge and understanding in different contexts. This trend of requiring candidates to apply knowledge is likely to continue.

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. Sometimes two answers are asked for but often only one response is given. Also occasionally the answer is left blank, probably as there is no answer line. At the end of question papers it is a good idea that candidates use their time to check for such omissions.

Calculation questions as a rule are being completed increasingly well. 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 [2 marks], many will incorrectly divide $6 / 3$ to get 2 [0 marks].

Calculations are increasingly being asked where candidates chose 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 formula more demanding.

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.

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

The paper performed well and all questions were accessible to candidates. Centres targeted these candidates for the correct tier with very few candidates scoring above 45.

There were several instances of candidates failing to read the question correctly and giving answers that were already given in the question. Question 9b was a good example of this, with pictures and videos being common answers.

Comments on Individual Questions

- 1(a) Parts (i) and (ii) proved more difficult than expected with only a third correctly answering (i) correctly and about a quarter answering (ii) correctly. The majority of candidates gave A as the answer to (i) and C as the answer to (ii).
- 1(b) The majority of candidates knew that heat was a form of energy.
- 2 The majority of candidates completed the sentences correctly. Whilst air was the preferred answer examiners accepted any reasonable named gas from air such as oxygen or nitrogen. Insulator was the only acceptable second word.
- 3(a) Approximately half the candidates answered part (a) correctly. The majority selected the correct formula but as this is given at the front of the paper there was no credit given. When it came to substitution approximately half the candidates put the 120 000 as the energy output and the 30 000 as the energy input giving an efficiency of 4. This is a common error and candidates would benefit from practice at substitution in expressions that give decimal answers less than 1.
- 3(b) Approximately half the candidates stated that the air rises or forms a convection current but a significant number of candidates gave a vague answer such as 'spreads round the room' or 'warms the room' which was not worthy of credit.
- 3(c) The majority of candidates gave the correct answer. Examiners did not accept the non-scientific answer 'bounced off the surface'
- 4 This question was also on the higher tier paper and was answered poorly by foundation candidates. The majority had not read the question correctly and answered the question 'describe how the food is cooked' – missing out the important word safely. The majority of candidates took all the space to describe cooking and squeezed a couple of words about microwaves escaping in at the end. Examiners were looking for statements that: microwaves could penetrate the plastic /glass container or would be reflected if a metal container were to be used; shiny metal sides reflect the microwaves into the food; mesh in the door prevents microwaves escaping; microwaves can damage living cells.
- 5(a) In part(i) most candidates correctly identified the other signal as digital, but found it more difficult in part (ii) to explain what was meant by an analogue signal. Examiners were looking for the idea that it is a continually variable signal.

- 5(b) Surprisingly less than half the candidates correctly chose reflection for the answer. The most common answer was refraction.
- 5(c) About 1 in 5 correctly chose the correct answer to part (i). In part (ii) the majority of candidates gave the correct answer 'portable' although a significant number of candidates repeated the question, giving the answer 'it does not need wires' or 'plugging in'. Part (iii) proved difficult for the majority of candidates. Many thought (incorrectly) that it increased the distance that messages could be sent whereas it increased the speed of communication and also allowed code to be used.
- 6(a)&(b) The majority of candidates knew that shock waves caused damage to the Earth's surface although several candidates thought that the shock waves moved the tectonic plates and caused earthquakes. Far less were able to name the instrument used to detect earthquakes.
- 7(a) The majority of candidates were able to correctly complete the sentences. Of those who made mistakes the most common error was 'A photocell transfers heat into ...'.
- 7(b) Very few candidates scored any marks on this question and only about 2% got the question completely correct. The most common error was to describe how solar panels or photocells work transferring light into electricity. Of those who did score it was mainly for the IR (heat) energy from the sun entering the room during the day. The majority of night answers were that 'the heat was trapped' or that 'the room went cold'. Neither of which scored any marks. Examiners were looking for the idea that energy was absorbed by the walls etc during the daytime and emitted from the walls etc at night.
- 8(a) Most candidates correctly named a non-renewable fuel used in power stations in part (a).
- 8(b) In part (b) the correct name of a renewable fuel used in power stations was a rare occurrence. Most candidates named a renewable energy source such as wind or water. Examiners were looking for manure, straw, wood etc.
- 8(c) About a third of candidates knew that the waste was radioactive.
- 8(d) The calculation proved difficult for the majority of candidates often being a factor of 10 out. Candidates should be advised to check their working with a calculator no matter how simple the numbers.
- 9(a)&(b) The majority of candidates were able to state two essential supplies for a manned spacecraft but in part (b) only about half the candidates gave a correct answer. The question asked about information about the planet being sent back other than photographs. Several candidates suggested rock samples, others suggested information about the universe, not related to the planet.
- 9(c) Part (i) required the answer dust and ice which was given by about 10% of the candidates, the most common answer was rock and ice which failed to score. Part (ii) often produced "an object near the earth" as an answer. Examiners were looking for the idea that it was an object that passed near to the earth and was on a possible collision course or provided a threat to the earth.

- 10(a) About 30% of candidates were able to answer part (a) correctly. The examiners were looking for the straightforward foundation level statements that the big bang was an explosion and that the universe is expanding. Several candidates thought that the big bang was a collision of planets and described changes on earth such as global warming.
- 10(b) Candidates found difficulty in answering part (b) with quite a large number of candidates offering no response. About 1 in 8 candidates correctly scoring one mark and 1 in 20 full marks. Examiners were looking for the idea of a collision between planets, and the Moon being formed from the debris of the collision.
- 11(a) Most candidates scored 2/3 in this section giving correct answers for (i) (iii) (iv). Part (ii) caused most problems with the majority of candidates stating that Alice lost kinetic energy in the fall.
- 11(b) Approximately half the candidates gave a correct answer to part (b). Many candidates gave vague answers such as change her shape or even suggested that she gain weight. Examiners were looking for ideas to reduce air resistance and credited descriptions of streamlining such as 'take a dive position' 'put arms close to the body' etc.
- 11(c) There was an even split between correct answers air resistance or drag and the incorrect answer upthrust. In part (ii) the majority gave the correct description 'up'. A few candidates gave a direction North which did not score.
- 12 This question was poorly answered by the majority of candidates. It was clear that many had no idea how a speed camera works. Examiners were looking for three points from: the idea that some form of radar detected a speeding car; two pictures were taken; fixed time between pictures; distance car travels measured from marks on road; speed calculated by distance travelled divided by the time between flashes. Some candidates described the use of average speed cameras which was also credited.
- 13(a) The majority of candidates were able to calculate the power of the brakes correctly.
- 13(b) Both (i) and (ii) were answered correctly by the majority of candidates.
- 13(c) Only about 5% of candidates managed to link a safety feature protecting the driver and not absorbing energy. The most common correct answer was roll cage (or description) other correct answers include collapsible steering column and laminated glass windscreen.
- 14(a) The majority of candidates correctly calculated the acceleration of the car.
- 14(b) Candidates rarely gave the correct answer, doubling being the most popular answer.
- 14(c) About 1/4 of candidates gave the correct answer to part (i), the majority of candidates correctly answered part (ii) and again about 1/4 of candidates correctly answered (iii). Examiners did not accept the answer just to stop a crash but looked for the idea that the braking distance would be greater or that the caravan would continue to try to push the car forward.

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

General Comments

In summary, the paper had a wide range of questions that examined most areas of study in Modules P1, P2 and P3 to an appropriate level, and with opportunities to stretch the most able candidates.

There was a good distribution of marks, but still a number of candidates who were obviously attempting the wrong tier and gained very few marks. However, in the vast majority of cases Centres had the entry level right and had adequately prepared their candidates for the examination.

Calculations were generally well done, often better than the written answers.

Comments on Individual Questions

- 1(a) A lot of candidates referred simply to change of state, melting, latent heat, and even specific heat in their answers. Better answers that did not gain credit mentioned 'bonds' without any reference to 'intermolecular' or 'between particles'. Some candidates wrote about breaking **forces**. Despite it being a one mark response this question differentiated well (less than 30% were awarded the mark).
- 1(b) This question was well answered, except when candidates tried to give answers in J/g or failed to write J/g after their answer. A small number multiplied the energy and the mass.
- 2(a),(b)&(c) All parts were well answered with success rates being very high in all three parts.
- 2(d) Approximately half of the candidates scored at least one mark (only 1 in 8 gained both). When one mark was scored 'expansion' (energy or heated/warmed often the response offered), whilst in zero mark answers density increased was usually the wrong start in the answer. This was a sentence completion question that candidates found far from easy.
- 3 Many weaker candidates repeated statements from the stem and did not expand on them. Depth of microwave penetration was a part of many answers that did not hit the marking points or **answer the question**. A significant number talked about reflection of **heat** and many did not understand the purpose of using plastic and glass thinking that they were good **conductors**. A surprising number thought the mesh strengthened the door because the glass might otherwise melt or that the mesh was to protect the user in the event of an explosion. The explanation of **how** energy reached the centre of the food was often inadequate or incomplete. Vague references to microwaves being harmful or dangerous with no mention of humans or 'the user' characterised too many responses.
- 4(a) Good answers from the better candidates but 40% of the answers failed to score. 'Varying' was the common incomplete response; many candidates clearly did not appreciate that digital signals **vary** (between 0 and 1). The idea of a range of / many values or **continuously** variable was beyond the understanding of a large number of candidates (approximately 40%).

- 4(b) Candidate responses often showed a complete lack of knowledge of this topic area. Centres are advised that practical work involving TIR is beneficial for candidates to gain a good understanding of these ideas.
- 4(c) This was well answered; a large proportion of the entry understood that interference could occur. Signals becoming totally mixed was often the wrong approach to the answer.
- 5 A difficult concept was opened up to allow access to more candidates. Waves in 'unison' or 'line' occurred several times in wrong answers to the second part.
- 6 Most candidates gained the first mark but lots failed on the second. **Solid** in the third space or **inner core/crust** in the fourth space were popular incorrect selections from the list provided.
- 7(a) There was often confusion here with thermal solar panels or even photocells. Problems with the first mark were generally because of **heat** entering rather than energy/waves or weak responses like 'sun shines in', 'sun goes into room'. However, there were some really good answers about IR being emitted and the change in wavelength.
- 7(b) Part (i) was generally well answered. Most candidates appreciated that the photocells used a renewable energy source, did not need a fuel or did not emit pollution. Poor answers to part (ii) stated 'it doesn't work at night' or failed to mention that photocells can only 'collect' energy (to charge a battery) in day or sunlight. Very few candidates used the idea that the cell's surface could be dirty or that little electricity is produced. In part (iii) very few candidates scored two marks. More candidates scored one for electrons being freed / knocked off silicon (atoms) but didn't mention the light being **absorbed**. In fact the term 'absorbed' was rarely used by candidates. Similar to 7(a); answers referring to solar panels/heating were common and somehow managed to link these items to the release of electrons. A surprising number of candidates thought that **heat energy** was absorbed by the photocell to release electrons.
- 8(a) A number of candidates referred to the photograph in the question to describe how electricity was generated rather than just saying **burnt**.
- 8(b) Fermentation was very rarely seen, neither were the other allowed versions on the Mark Scheme. Very few candidates gained this mark (fewer than $\frac{1}{4}$ of the entry) even though it was targeted at D grade and directly tested a specification statement. Also there was a surprisingly number of 'no response' here ($\frac{1}{4}$ failed to respond).
- 8(c) Few two mark answers were recorded. Answers referring to 'leaks' were often not specific enough to gain the mark for leakage into the groundwater or contaminating the water supply. The most common non-scoring answers were about the amount of land used up to accommodate the waste or danger to wildlife. The idea of the waste remaining radioactive for a very long time was very poorly expressed or not understood.

- 8(d) Some excellent, precise answers but a lot not making clear a **reduction** in energy loss was being sought, or neglecting to mention lower current. Answers referring to a higher speed of transmission or delivery of power / energy seemed to occur quite often. The reduced energy loss mark was more often scored than that for low current. A few confused candidates seemed to think that high voltage transmission was an alternative to low current. Few identified that high voltage meant low current, and a large number believed that voltage was lost, so it would arrive at the point of use without the required value or not deliver energy at the end-point.
- 9(a)&(b) Generally well answered with slightly higher success in (b). Death of the astronauts figured in poor answers with no reference to timescale.
- 9(c) Many thought comets were composed of ice and **rock** (a low rate of gaining the mark, less than 30% scored the mark).
- 9(d) This was quite well answered with many scoring this mark. The most common mistake was to fail to explain why a spacecraft (or merely 'object') was being directed to the NEO. A few candidates recounted the plot of the film Armageddon.
- 10(a) Usually well done by the better candidates, some candidates only scored one mark because they confused pence with pounds or watts with kilowatts, whilst a significant minority lost both marks for only completing half the calculation. Cost of electricity continues to be one of the calculations that many candidates struggle with.
- 10(b) Those that did score in this question usually did so by means of 'more / less demand' or references to power station never (normally) turning off / continually running appearing in their answer. Spreading demand' was not found very often. A significant number seemed to think that the whole idea of off peak electricity was a ploy to get more people to use more electricity. In many cases the answers were confused and/or contradictory. A large number thought that it was cheaper to generate electricity at night due to low wage costs.
- 11(a),(b)&(c) The ideas about falling objects are well understood by the majority of candidates, however, there was imprecision in the way basic ideas were expressed e.g. 'balanced forces' were 'almost equal, level, even'. The distinction between gravity and weight is clearly not well understood and Centres should try to distinguish between the two terms in their teaching.
- 11(d) Less than one third of the entry gained full marks. 'Gravity' for the first two parts and 'her or air' in the last were the most frequent mistakes.
- 12(a) Even with a formula rearrangement this was very well done; over 90% gained full credit.
- 12(b) Some excellent responses which were usually succinct and straight to the relevant points whilst others indicated total lack of understanding. Many answers were difficult to interpret due to lack of precision. There were frequent contradictory responses and it wasn't always clear whether the subject was the car or driver/passenger. A two mark response was not particularly common (about ¼ candidates gained both marks). Poor expression was often their undoing because candidates all too frequently wrote about **slowing acceleration** instead of **reducing** acceleration. A significant number wrote about the stopping time being decreased or happening quickly, missing the point completely. The need to distinguish between stopping time in terms of a car braking and the stopping time for a person in a car crash/collision is a clear priority for future teaching.

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- 12(c) The most common scoring response here was the idea of less distraction. The majority scored this mark. There were quite a few talking about safer because the windows would open more quickly following an accident, or the windows wouldn't shatter; which are not necessarily true and irrelevant in the context of the question. Providing extra reinforcement in a crash was another common misconception.
- 13(a) Very well answered on the whole. Wrong answers were usually due to incorrect subtraction of the initial and final speeds.
- 13(b)&(c)(i) Reasonably well answered (just under half of the candidates gained each mark).
- 13(c)(ii) Very few two mark responses in part (ii), the mark gained was usually for the idea of 'more energy'. Many candidates only stated that there was more mass without going on to explain that more work would be done or describe any increase in frictional or resistive forces.
- 13(d) This calculation was constructed within the scenario of the car and caravan. This resulted in a demanding question that provided a high degree of stretch and challenge. Many gained a mark for partial answers (6000 for two marks or less frequently 3000 for one mark), but a fair number of the more able candidates who were able to reason through the stages of the calculation achieved full marks (approximately 25%).

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

General Comments

This was the seventh occasion this examination was available to be sat by candidates. There were 136 candidates and marks ranged from 7 to 49 out of 60.

The mean mark for the paper was 30 and the paper discriminated satisfactorily over the target grade range of G to C.

There was little evidence that candidates had insufficient time to complete the paper and the only question which was omitted by a significant number of candidates (23%) was 6b. A small minority of candidates did not follow instructions regarding how to answer questions or how many answers to provide. Where the intentions of the candidate were clear, marks were awarded.

Candidates are encouraged to show how they work out the answer to numerical questions. In this way, credit can be given for showing how an answer is obtained, even if the answer is incorrect. It was pleasing to note that this was more evident than in the past. In general, calculations were well answered by all candidates.

Comments on Individual Questions

- 1(a) This was intended as an accessible starter and the majority of candidates were able to answer all parts correctly.
- 1(b) Few candidates scored this mark. Many wrote slow moving as their first answer and nucleus as their second.
- 2(a) The majority of candidates scored both marks. Some were awarded a mark for showing their working. Only a few failed to score any mark.
- 2(b) Half the candidates correctly stated that the circuit was broken. A common error was to describe the action of the fuse as blowing or blowing up the circuit.
- 3 This question discriminated well. Few candidates failed to score a mark, and many scored two. A common error was to assume that the metal object was of the opposite charge.
- 4 Two thirds of candidates scored at least one mark. The most common error was to assume the charge on the car was the same as the charge on the paint.
- 5 The majority of candidates scored at least one mark. A common error was to state that nuclear radiation is used to clean (instead of sterilise) hospital equipment. A number of candidates believed that gamma rays are used to treat gall stones.
- 6(a) Half the candidates knew the term wavelength as applied to a longitudinal wave.
- 6(b) Only a few knew the term rarefaction, of whom the majority misspelled the word as rarefraction. The most common answer was decompression.

- 7(a) The majority knew the term aerial or antenna. Receiver or dish were common responses.
- 7(b) There were some good answers as candidates wrote about reflecting from the atmosphere or ionosphere. The idea of diffraction as a spreading around the flats was rarely discussed. Vague answers, such as goes around the flats, were not credited.
- 8(a) A quarter of candidates knew the difference between speed and velocity. Many described the difference as one measuring how fast and the other how far. Acceleration was also mentioned quite often.
- 8(b) A third of candidates correctly calculated the final velocity, but many failed to perform the mathematical operations in the correct order and obtained a variety of incorrect responses as a result. Most realised that the momentum would increase as the car accelerated.
- 9(a) Just over half correctly chose refraction as the answer. The most common distractor was diffraction.
- 9(b) Many candidates ignored the advice that words could be used more than once and as a result a number of interesting incorrect answers were seen.
- 9(c) Dispersion as a term and as a process is not well known or understood. Diffraction was the most common answer.
- 10(a) Uses of satellites are well known. It was pleasing to note that previous comments regard the answer weather have been acted upon and most who chose this use referred to forecasting or monitoring.
- 10(b) Most recognised gravity as the source of the centripetal force. Answers regarding the meaning of geostationary tended to be too vague to be worthy of credit. There had to be a clear understanding of the relative position to Earth. A surprisingly high number of candidates did not appreciate that a geostationary satellite takes 24 hours to orbit the Earth. Both 12 hours and 42 hours were commonly seen as responses.
- 11(a) Most scored all three marks but many did not know the correct symbol for a battery. A symbol for a cell was accepted.
- 11(b) Few knew that a variable resistor is required to alter the brightness of a bulb.
- 11(c) Half the candidates chose increases and half chose decreases. The effect of temperature on the resistance of a bulb is not well known.
- 12(a) Whilst half the candidates correctly chose the direction in which the wire would move when the current reversed (all other possible choices were seen), the effect of reversing just the magnet instead produced a lower (30%) correct response.
- 12(b) Although the majority of candidates correctly identified a household appliance containing a motor, items such as kettle were listed.
- 13(a) About half the candidates correctly chose the LDR as the electronic device to switch on an outside light. Solar cell was a commonly chosen distractor.

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- 13(b) Two thirds of candidates believe that the resistance of a thermistor increase as the temperature increases. There is obviously confusion in candidates' minds about the effect of temperature on resistance, both of thermistors and bulbs (Q11c).
- 14 Candidates often wrote about increasing the number of turns, increasing speed and stronger magnets but also wrote of larger magnets and increasing the current.
- 15 The majority of candidates correctly identified three of the four uses of transformers but few scored both marks. There was no pattern in incorrect responses.
- 16(a) Two thirds of candidates correctly identified the current direction with a diode in circuit, but few knew the job of the diode.
- 16(b) A very small minority knew the job of the capacitor. There were no common misconceptions and a fifth of candidates did not attempt the question.
- 17(a) Most completed the truth table correctly.
- 17(b) A third of candidates scored the mark for suggesting why a latch is used in an alarm circuit. Candidates have been much better prepared for this question than in the past.

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

General Comments

This higher paper produced a mean mark of 34 which was comparable with previous series. The mark scheme was designed to reward and stretch where appropriate. There were no 'dead marks' on the paper but some marking points (eg polarisation description in question 3) were only achieved by the high A* performers.

Sections A (P4) and B (P5) showed higher performance. Section C often caught out candidates. It was here in P6 that significant numbers of candidates did not complete questions. This was not due to lack of time but more an unfamiliarity or lack of confidence with the unit, especially capacitors, latches, potential dividers and power loss in transmission.

Comments on Individual Questions

- 1(a) This was well answered with most candidates naming the helium nucleus as an alpha particle and a beta particle as a fast moving electron.
- 1(b) This half life question was well answered by a third of candidates. A common wrong answer was '3' (ie 3 half lives) rather than the number of years.
- 1(c) The background radiation source (natural and man-made) was well understood by most. Common answers were rocks/Sun and hospitals/nuclear power.
- 2 Over 90% of candidates successfully completed this calculation.
- 3 Most candidates scored two for the (negatively) charged screen attracting the oppositely charged dust. Only the most able were able to show understanding of polarisation. A very small number of candidates had a correct clear idea of what polarisation is, the majority scored for screen is charged and attracts dust.
- 4 This was a sentence completion type question about spray painting using electrostatics. It was answered well by most.
- 5(a) The question on nuclear fission commonly achieved one mark for parts 2 and 3. Common errors were to omit uranium in part 1. Also naming electrons instead of neutrons often lost the second mark. Radiation or nuclear radiation was also a common wrong answer here.
- 5(b) This question was well answered by most candidates.
- 6 A well answered question on ultrasound.
- 7 This was a generally well answered question on satellites. However, some candidates gave unclear responses by describing geostationary satellites as 'stationary' (rather than above same point on Earth over equator).

- 8(a) Many candidates commonly achieved one mark for longer wavelength but far fewer scored two and several misunderstood thinking that the diffraction caused a change in wavelength or that radio had shorter wave so diffracted more etc. Some thought that microwaves (rather than diffracting less) did not diffract at all. Some referred simply to the waves 'reflecting off the ionosphere'. This idea was often mistakenly carried through to the diagrammatic question on satellite TV.
- 8(b) Candidates had to label the satellite (this was often omitted) and show microwaves to it and from it to Australia. It was frequently the case that answers mixed up ideas with reflection of long wavelengths by the ionosphere. It was common for candidates to state that the waves were "sky waves" rather than microwaves.
- 9(a) In part (i) three quarters of candidates correctly calculated the final velocity. But several lost a mark for the answer due to their failure to correctly order the calculation in their calculators. The great majority knew the momentum increased with increasing speed in part (ii).
- 9(b) Only the most able candidates (as expected) could find the correct answer to the momentum calculation.
- 10 This question on light was well answered for the main but part 10(d)(iii) was deliberately challenging. Most referred to the light slowing or the wavelength changing. Better answers from the highest ability candidates referred to blue light slowing the most or having a bigger change in wavelength, both worth one mark. Rather fewer stated that blue has a higher refractive index. It was pleasing (but rare) to see two mark responses here.
- 11 There were mixed responses here and few candidates correctly applied the left hand rule twice. Some candidates correctly answered part (a) but often candidates could not believe that the answer to part (b) was the same. This was often seen to be a changed answer on the script.
- 12 Part (a) was well answered (lower resistance) but few mentioned lower resistance in part (b). Many restricted their answers to merely describing the graph or stating the non-ohmic relationship.
- 13 This generator question was well answered with many gaining two marks. Candidates who did not score often mistakenly wrote of motors and suggested increasing the current input. The most commonly omitted factor was faster rotation.
- 14(a) Answered well.
- 14(b) Few candidates could successfully apply I^2R or $VI=P$ in this demanding question.
- 15 The capacitor answers often referred to the storing of something too vague such as voltage or electricity rather than charge.
- 16 The truth table was completed very well and also the latch was frequently correctly connected (usually at least one correct connection) but the use and application of the potential divider very poorly done. Of those successful they generally calculated the correct voltage but could not explain why the LED was off.

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