

Physics B J645

Gateway Science Suite

General Certificate of Secondary Education

Report on the Units

January 2008

J645/MS/R/08J

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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 syllabus 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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

CONTENTS

GCSE Gateway Physics B J645

REPORT ON THE UNITS

Unit/Content	Page
B651/01 Foundation Tier	1
B651/02 Higher Tier	4
B652/01 Foundation Tier	7
B652/02 Higher Tier	10
Grade Thresholds	13

B651/01 Foundation Tier

General Comments

The paper had, as expected at this stage of the course, a very small entry. The paper was accessible to all candidates and very few candidates were entered for the wrong tier.

Comments on individual questions.

- Q1 In part (a) most candidates were able to score 3 marks for correctly linking insulation to location.
- Most candidates correctly calculated payback time as 4 years in (b)(i). Surprisingly, very few candidates realised that air is important because it is a good insulator. There were many vague answers such as 'keeps the room warm' which did not score.
- Q2 This question was about waves.
- In (a)(i) most candidates correctly identified Infrared as a wave used to cook food microwave was an equally acceptable answer.
- Infrared was correctly identified as the wave in a TV remote control in (a)(ii) by the majority of candidates and in part (iii) a majority of candidates identified skin cancer as the damage done to humans by ultraviolet waves. However, a significant number just wrote cancer which was not an acceptable answer.
- A significant number of candidates were unable to identify the parts of a wave in 2(b). The most common error was to mix up crest and amplitude.
- Q3 In (a)(i) the Examiners were looking for total internal reflection. The marks were given for an accurate reflection at the surface for the angle of incidence being approximately equal to the angle of reflection. A maximum of 6 reflections was allowed. Several candidates spoiled a perfectly good diagram by writing refraction in the answer.
- (a)(ii) Most candidates knew that digital signals only took the values 0 and 1 (1 mark) but could not always come up with the analogue description of taking any value within limits.
- (b) Most candidates were able to give two advantages: viz no wires and portable.
- Q4 Candidates were able to identify the ice as getting warmer and the hot tea as getting colder however some candidates got these the wrong way round.
- Only the better candidates scored on part (b). Examiners were looking for the idea that energy was needed to: melt ice / for latent heat / or for a higher level answer of breaking inter-molecular bonds.

Report on the Units taken in January 2008

- Q5 (a) (i) a surprisingly large number of candidates thought that a photocell transferred energy from the sun into heat. In part (ii) candidates struggled to give what Examiners thought was a straight forward answer of solar panels, heating, biomass, wind, wave.
- (b) The most common advantages were free to use once set up and renewable and in part (ii) no power if dark/at night was the most common disadvantage.
- Q6 (a) The majority of candidates scored full marks by moving the magnet near to the coil.
- In part (b) many candidates had the correct idea but used vague terms which did not merit a mark, Examiners were looking for stronger / more powerful magnets, words such as larger or bigger magnets did not score and for more turns on the coil, longer / larger / bigger coils did not score. Candidates could have also said move the magnet quicker.
- The majority of candidates correctly gave dc as the answer to part (c). The most common wrong answer was a description of the battery type as AA or AAA.
- Q7 Candidates struggled in part (a) to identify the renewable source from the list. Whilst wood was the most popular, coal and natural gas were regular answers. The majority of candidates were able to calculate the power rating of the fire as 1840(W). Similarly the majority of candidates identified *oven* as the most expensive appliance to use for 30 minutes.
- Q8 Part (a) proved more difficult than expected. Examiners were looking for any one of a variety of uses. Often candidates gave no response.
- In part (b) Examiners were looking for general safety precautions. The most common answer was protective clothing but often the answer stopped at that point. Candidates had failed to notice that there were two marks for this and therefore two responses were needed. The other less common answers that scored included remote handling and shielding.
- Q9 (a) Most candidates identified the objects orbiting the Sun as planets.
- (b) Some candidates thought they reflected light from the Sun and along with this Examiners did not accept they are bright as objects that do not give out light can be bright.
- In part (c) candidates often gave long complex explanations to what was a straight question. Examiners were looking for food/ water/ fuel/oxygen.

Q10 This question was about motion

(a) (i) Candidates put tape measure or metre wheel as correct answers to this question as in previous questions of this type, candidates were not credited for metre rule, as this was not thought suitable for the measurement of the distances involved. In the second box of the table several candidates wrote speed (incorrect) instead of the correct answer time. Seconds was not accepted as an alternative for time.

(ii) The majority of candidates correctly identified the correct units for speed.

Part (b) was well answered with (i) Audi and (ii) BMW being the most common answers.

Q11 (a) (i) There was a definite improvement in answers to this question but still too many candidates starting off with the thinking distance is the time..... Most candidates know that it relates to seeing the incident and applying the brake. Some candidates thought it was the distance until the car stopped.

(ii) The majority of candidates correctly calculated the stopping distance as 36m.

(b) The question asked about an *increase* in braking distance. A significant number of candidates just gave statements that affected braking distance such as 'how good the brakes are' and 'weather/ road /tyre conditions' which failed to score. Examiners were looking for qualification of these such as bald tyres, slippery roads , wet roads.

Q12 (a) Very few candidates identified the other sort of energy as kinetic.

(b) Candidates regularly stated that drag and weight were equal.

Parts (c) and (d) proved more difficult. Few candidates gave the correct answer D for the answer to (c) and it was rare to see both answers correct in part (d).

Q13 Most candidates successfully identified petrol and diesel in part (a) as the main fuels for cars.

Part (b)(i) produced a range of answers – all three choices being equally popular.

(b)(ii) was answered correctly by the majority of candidates.

Almost all candidates gave the correct answer of 45000 in part (c).

B651/02 Higher Tier

General Comments

The paper worked well with the majority of candidates scoring well. There seemed no problem with time and candidates completed the paper. There was little evidence to suggest that candidates had time on their hands. Centres are to be congratulated on their correct entry levels for the candidates with less than 1% of candidates scoring below 25% of the marks.

Comments on Individual Questions

Q1 The majority of candidates correctly calculated the output of the lamp as 5W in part (a)(i) and easily identified two advantages in (a)(ii).

In part (b) most candidates calculated the payback time as 4 years.

Part (c) proved more difficult it was expected that candidates would indicate that the foam trapped air. This reduced convection because the air could not move and that air was a good insulator hence conduction was minimised. The radiation was reflected by the shiny surface. Good candidates scored the three marks available but average candidates struggled with descriptions of air reflecting from the silver surface and the bubbles catching air as it tried to get through the wall.

Q2 (a) (i) Good candidates had no difficulty with this question with clear accurate diagrams and good explanations of total internal reflection. Weaker candidates rarely mentioned TIR and often penalised themselves by putting many reflections at what was clearly less than the critical angle. Examiners accepted a maximum of 6 reflections for a correct diagram of total internal reflection.

(ii) There were many good answers Examiners were looking for digital having fixed values of 0 and 1 (other terms accepted) and analogue able to take any value within a range.

In part (b)(i) multiplexing was rare and in (b)(ii) an explanation of why there is less interference was even rarer. Most candidates repeated their answer to (a)(ii) in the hope (erroneously) that it would score a mark.

Q3 (a) A similar question had appeared on a previous Science B paper and was very poorly answered. This time examiners carefully prompted the question indicating to the candidates what was needed for the marks. This proved very successful. The best candidates scored all 4 marks on this with average candidates scoring 1 or 2. The weaker candidates struggled often constructing any sentence they could containing the prompt words.

(b) Whilst the best candidates explained the effect by the breaking of intermolecular bonds few explained it in terms of latent heat. The majority of candidates just said the ice was melting or changing state which was not credited.

Q4 This proved a difficult question for the majority of candidates. It was clear that they did not know about laser beams or how they got information from a disc.

- Q5 (a) The majority of candidates were able to give an advantage of photocells – usually that they used renewable energy and also a correct disadvantage - that they would not work at night.

Part (b) produced some interesting answers. Examiners were looking for the straightforward answer that there were large windows (1) facing the sun / facing south (1). These answers were rarely seen with the majority of candidates describing the use of solar panels to heat water. Whilst it was still possible for candidates to score full marks describing the passage of infra red through the glass and becoming trapped the majority of candidates failed to score more than 1 as their statements became vague and inaccurate.

- Q6 (a) The majority of candidates scored full marks on this question, of those failing to score full marks many used vague terms such as make the coil longer or bigger magnet which were not accepted by examiners.

Part (b) usually gave the correct answer of 35% or 0.35 too often, those candidates giving 0.35 as an answer also added a unit making the answer incorrect.

Surprisingly in part (c) few candidates mentioned reducing the current and just gave the answer to reduce energy loss scoring only 1 of the 2 marks.

- Q7 Part (a) proved straight forward for the majority of candidates with 1840W being the correct answer.

There were 3 marks for part (b) and the average candidate scored 2 of these. A surprising number of candidates thought nuclear fuel was renewable. A full list of the answers that were accepted is in the published mark scheme.

- Q8 Most candidates correctly identified the position of the Asteroid Belt in part (a).

In part (b) candidates seemed to be looking for hidden difficulties in the question. Examiners were looking for answers such as sufficient amounts of food, water, fuel, oxygen. Along with it would take a long time or is a large distance to travel. Many of the answers were concerned with difficulty for repair or spare parts for the space ship and keeping people alive long enough.

A majority of candidates correctly answered part (c) although some thought it was because they became lighter as the ice melted as it went past the Sun.

- Q9 (a) (i) Most candidates scored 2 marks for explaining that there was insufficient distance to think and stop before the driver in front was stationary. To score full marks they needed to go on and state that this would lead to a crash.
- (a) (ii) Most candidates were able to identify icy road or bald tyres etc as reasons for increasing the braking distance. A few candidates confused braking and thinking distance but a significant minority gave vague answers that would change the braking distance such as road conditions, weather, how good the brakes/tyres are etc. Answers such as this failed to score.

Report on the Units taken in January 2008

Part (b)(i) proved difficult for all but the best candidates. The most usual incorrect answer was 216 where candidates had failed to halve the area between 0.75 and 6.75 seconds. Examiners credited the work that had been done and awarded marks as follows. 120m 3 marks, 216 or 96 2 marks because there was only one mistake, either not adding the thinking distance or not calculating the area of the triangle correctly and 1 mark if there was an indication that the area was needed, or they added 24 to any calculated number.

Part (b)(ii) often scored 1 or 2 candidates did not explain the answer not realising that the force was fixed in the first situation and reduced in the second situation but meaning a greater distance to do the same work.

- Q10 (a) The majority of candidates knew that weight and drag were equal at terminal speed.

In part (b) candidates stated that drag had increased but often failed to relate it to an increase in area of the parachute.

- Q11 This proved an easy question for the end of a paper.

In part (a) the majority of candidates calculated the distance travelled as 80m and were able to suggest two reasons for different fuel consumptions.

Part (c) usually produced the correct answer of 45 000J

B652/01 Foundation Tier

General Comments

This was the first occasion that this examination was available to be sat by candidates. There were only 37 candidates and marks ranged from 5 to 45 out of 60. A quarter of the candidates achieved a grade C and there was no evidence that candidates had been incorrectly entered for the foundation tier paper. A relatively low percentage of candidates achieved grade F or better suggesting that some had not prepared themselves fully for the examination.

The mean mark for the paper was 22.9 and the paper discriminated satisfactorily over the target grade range of G to C. The paper gave candidates the opportunity to demonstrate positive achievement in physics.

There was little evidence that candidates had insufficient time to complete the paper but there were a good number of occasions where parts of questions and indeed whole questions were omitted. Some 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, however on occasions it was not always clear what the candidate meant so no marks could be scored.

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.

Comments on Individual Questions

- Q1 (a) The majority of candidates correctly identified the circuit in which the bulbs were not lit.
- (b) The colour of wires in a plug was not well known.
- (c) Most candidates appreciated that a fuse or circuit breaker were for safety.
- Q2 (a) Candidates failed to appreciate that the rod had to be charged to attract the pieces of paper.
- (b) Candidates could describe how someone wearing trainers could be come charged and why they received a shock.
- (c) A significant number of candidates did not attempt this part of the question. Those who did provided some very good answers.
- Q3 (a) Whilst most candidates knew the meaning of frequency, few understood the difference between compression and rarefaction.
- (b) Few candidates appreciated the difference between sound and ultrasound as simply being a difference in frequency and the fact that ultrasound is beyond the human audible range.

Report on the Units taken in January 2008

- Q4 This question was poorly answered. Many candidates failed to attempt at least one part of the question.
- (a) There were few correct answers. Doctor was a common incorrect response.
 - (b) Penetrative properties of nuclear radiation were not well known.
 - (c) Many candidates were unable to recall a use of radioisotopes in hospitals.
- Q5 Nearly a third of the candidates failed to attempt either part of this question.
- (a) Some candidates knew that splitting of the atom was a fission process or a chain reaction.
 - (b) Few knew the outcome of an uncontrolled chain reaction.
- Q6
- (a) The most common error seen was for the beam to remain parallel as it passed through the lens.
 - (b) A good number of candidates failed to indicate a focus.
 - (c) This mark depended on a correct ray diagram. Those who drew a correct diagram invariably scored the mark.
 - (d) Most candidates correctly identified the convex lens.
- Q7
- (a) The majority of candidates knew that a spectrum of colour was formed by a prism, but could not fully explain how this was achieved by refraction and dispersion.
 - (b) Most named a transparent material from which a prism could be made.
 - (c) Almost every candidate continued the path of the ray as it passed through the prism. There were few answers showing a reflected ray.
- Q8
- (a) The majority of candidates correctly identified the path of the stone thrown from the cliff.
 - (b) There appeared to be a lot of guesswork when answering this question. The fact that the stone maintained a constant horizontal velocity was not well known.
 - (c) Most candidates recognised the arrow shot from a bow as an example of a projectile.
 - (d) Many candidates failed to calculate the distance travelled by the stone. The equation was given in the question booklet. The division of speed by time was a common error.

Report on the Units taken in January 2008

- Q9 (a) A surprising large percentage of candidates did not know that the Moon is the Earth's natural satellite. Pluto was a common distracter.
- (b) This question was well answered. Most knew that gravity keeps satellites in orbit.
- (c) The majority of candidates could list at least one use of a satellite. It was common to see aspects of communication being given as answers.
- (d) This question was well answered. Most knew that it takes 24 hours for a geostationary satellite to orbit the earth.
- Q10 (a) Most candidates could identify the symbol for a cell.
- (b) The effect of resistance on current is not well understood.
- (c) The heating effect of a current was not well known. Most thought the student had received an electric shock.
- (d) The majority of candidates scored at least one mark and there was more evidence of candidates showing their working when answering this question. The unit of resistance is not well known.
- Q11 (a) Many candidates suggested that a NOT gate worked from either a 24 V or a 230 V supply.
- (b) The truth table for a NOT gate was known by the majority of candidates.
- (c) Half of the candidates realised that the output from a NOT gate would only light an LED.
- Q12 Nearly a quarter of the candidates failed to attempt any part of this question.
- (a) The term step-down was not familiar to many candidates.
- (b) There were few correct answers.
- (c) The use of an isolating transformer was not well understood.
- (d) Few candidates could extract the frequency correctly from the information provided.
- Q13 (a) The shape of the magnetic field around a wire was not well known, nor is the effect on the wire when a current passes.
- (b) A minority of candidates appreciated that the wire moved in the opposite direction.
- (c) The majority of candidates could correctly identify a kitchen appliance containing an electric motor.

B652/02 Higher Tier

General Comments

This was the first occasion that this examination was available to be sat by candidates. There were 77 candidates and marks ranged from 18 to 51 out of 60. Over half of the candidates achieved a grade A or A*. There was no evidence that candidates had been incorrectly entered for the higher tier paper. Unlike their peers entered for the foundation tier paper, these candidates had thoroughly prepared for the examination.

The mean mark for the paper was 38.9 and the paper discriminated satisfactorily over the target grade range of C to A*. The paper gave candidates the opportunity to demonstrate positive achievement in physics and many did so.

There was little evidence that candidates had insufficient time to complete the paper and there were few occasions where any part of a question was not attempted.

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.

Comments on Individual Questions

- Q1 (a) This question was well answered. The repulsion between like charges was well understood.
- (b) The majority of candidates provided good explanations as to how electrostatics assisted paint spraying of a car. Many candidates scored full marks.
- Q2 (a) Almost every candidate correctly calculated the value of the current in the shoe.
- (b) The reason for earthing equipment and surfaces in an operating theatre was not well explained by many candidates.
- Q3 (a) The majority of candidates scored at least one of the marks but it was expected that candidates would write about the higher frequency and that it was beyond the threshold of hearing.
- (b) The majority of candidates could provide one reason for using ultrasound in preference to X-rays. The lack of damage to cells was not as well known.
- Q4 (a) The penetrative properties of nuclear radiation were well known.
- (b) Candidates generally did not appreciate that a chain reaction involved the splitting of the nucleus and the release of neutrons to continue the reaction. Many answers were too vague to gain credit.
- (c) The use of gamma radiation as a tracer was clearly explained although candidates often found it difficult to explain how the position of a blockage could be identified.

Report on the Units taken in January 2008

- Q5 (a) Most candidates knew that a beta particle is an electron but failed to qualify this in terms of its speed. A good number of candidates did explain how the beta particle is formed in the nucleus.
- (b) This question was not well answered. Few candidates could correctly calculate the number of protons and neutrons after the emission of a beta particle.
- Q6 (a) This question was well answered. The most common error was for the beam to remain parallel as it passed through the lens.
- (b) The majority of candidates knew how to adjust the lens in a camera when taking pictures at different distances.
- (c) Whilst most candidates could list one way in which the image on a film is different from the image in a magnifying glass, only the more able candidates could suggest two differences correctly.
- Q7 (a) The fact that the stone maintained a constant horizontal velocity was well known.
- (b) Most candidates correctly calculated the distance travelled by the stone. Those who did not do so divided speed by time.
- (c) This question was not well answered. The majority of candidates failed to appreciate how to calculate relative velocity.
- Q8 (a) This question discriminated well. The more able candidates gave good descriptions of the experimental procedures as asked. Weaker candidates failed to answer the question fully and only described how interference is caused.
- (b) Many candidates gave the reverse answers to those expected or contradicted themselves within each answer by stating, for example, that dark bands were constructive interference where peak met trough.
- Q9 (a) Almost every candidate knew that it takes 24 hours for a geostationary satellite to orbit the earth, but found it difficult to explain in more detail what is meant by geostationary orbit.
- (b) This question was well answered. Candidates knew that a weather satellite orbited at a lower altitude and could provide some explanation as to why it is important to have a short orbit time.
- Q10 (a) The majority of candidates could correctly use the transformer equation.
- (b) The use of an isolating transformer in a shaver socket was not well understood.
- (c) The reduction in energy loss through high voltage transmission was well known, but the effect on current and the relationship between current and energy loss was less well known.

Report on the Units taken in January 2008

- Q11 (a) Almost every candidate could explain the relationship between resistance and current.
- (b) Whilst candidates could use the equation to calculate the resistance of a wire, it was disappointing that there were many who could not transfer the information correctly onto the graph. Lines were often drawn carelessly, failing to pass through the origin or pass through the quoted values of 0.5 A 1.5 V.
- Q12 (a) Whilst most candidates correctly completed the input values for the NOR gate truth table, only the more able could work out the output values correctly.
- (b) The action of a latch was not understood. Few candidates scored any marks.
- Q13 (a) A majority of candidates appreciated that the wire moved in the opposite direction. Some did not express their answer clearly enough to gain credit.
- (b) Whilst most candidates knew that the speed of a motor depended on the current, only a small number showed any appreciation of how a split-ring commutator works.

Grade Thresholds

General Certificate of Secondary Education
Physics B (Specification Code J645)
January 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B651/01	Raw	60	-	-	-	38	30	23	16	9	0
	UMS	100	-	-	-	60	50	40	30	20	0
B651/02	Raw	60	49	40	31	23	16	12	-	-	0
	UMS	100	90	80	70	60	50	40	-	-	0
B652/01	Raw	60	-	-	-	34	27	21	15	9	0
	UMS	100	-	-	-	60	50	40	30	20	0
B652/02	Raw	60	46	39	32	26	20	17	-	-	0
	UMS	100	90	80	70	60	50	40	-	-	0

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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

OCR Customer Contact Centre

14 – 19 Qualifications (General)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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