Report on the 2012 WACE examination in
Physics Stage 2

Year	Number who sat	Number of absentees
2012	33	2
2011	37	3
2010	81	7

The overall mean of the paper was 66.7%, higher the 2011 mean of 59.8%. The markers commented on the higher quality of candidate's answers, when compared to previous years. The examination was of an appropriate length as the candidates did not appear to be rushed.

The internal reliability of the paper was good at 0.79. Feedback from teachers and candidates indicates that the paper was well-received as a fair and valid examination of syllabus content.

The paper was a good discriminator despite the small candidature, producing scores ranging from 27% to 96% with a standard deviation of 16.85%, slightly less than last year. The means for sections were: Section One: Short answer 70.5%; Section Two: Problem-solving 65.5%; Section Three: Comprehension 61.2%.

General comments

Both Unit 2A and 2B were examined equally this year. The cohort this year demonstrated more ability than in previous years with the range of examination scores of 27% – 96% (last year, 21% – 88%). Candidates preformed well on questions dealing with simple concepts and one step calculations, such as Questions 1, 5 and 18. Candidates continue to under-perform on the topics dealing with experimental method and interpretation of given information. For example, in Question 2 very few could determine the absolute uncertainty when measuring, in Question 12 candidates had difficulty in applying concepts of kinetic theory and in Question 23 candidates dealt poorly with applications of experimental error.

Section One: Short answer had a range of 38% – 100% (last year, 15% – 98%) and Section Two: Problem-solving 18% – 92% (last year, 14% – 88%). For Section Three: Comprehension the question was less difficult for this cohort this year with a mean of 61% (last year, 51%), where the range was 6% – 100% (last year, 0% – 90%).

Advice for candidates

Candidates are reminded that extended responses can be expected for all topics listed as examinable in the syllabus. It is not enough to write information learnt by rote; candidates must also be able to provide details, examples, reasoning and explanations as specified in individual questions. Candidates should note that the unit content headed Working in Physics is examinable.

Advice for teachers

Candidates need to be given time in class to apply experimental methods in context – determining absolute error; interpreting sources of errors, rather than blaming the inadequacies of their equipment or inability to read a scale; and plotting data or interpreting graphs. Practice in answering comprehension questions, for example, as part of candidates' school-based assessment program, would be helpful examination preparation. Teachers should note that Working in Physics is examinable. This part of the syllabus is best addressed in practical lessons.

Comments on specific sections and questions

Section One: Short answer

Question 1

This was an easy question on vector addition to begin the paper.

Question 2

This was expected by the examiners to be an easy question on reading scales and estimating uncertainty, but was poorly done. Most candidates could read the scale on the spring balance and some the graduated cylinder but very few showed understanding of uncertainty in reading a scientific instrument.

Question 3

This was an easy question on labelling a helium atom and in general candidates handled it well. However, 20% of candidates did not attempt this question.

Question 4

Part (a), as expected, was an easy question. A few candidates gave the same answer for (a) and (b), indicating a lack of understanding of the difference between the use of distance in speed and displacement in velocity.

Question 5

The majority of candidates could complete a nuclear equation and correctly identify an alpha particle. Calculating half-life was also well understood but few used the half-life equation.

Question 6

The discussion of electrical safety and the associated dangers were well handled by the candidates.

Question 7

Graphing is an area of weakness for most candidates. Most candidates who correctly completed the graph could calculate the acceleration. Many candidates correctly inserted the negative sign in the acceleration.

Question 8

Almost all candidates could draw a simple series and parallel circuit. In part (b) candidates had difficulty in showing an understanding of how placing resistors in series or parallel affected the amount of current and hence brightness of globes.

Question 9

A large proportion of candidates did not attempt this apparently straightforward question on heat transfer, and few of those who attempted it achieved good marks. The mean for the question was 37%.

Question 10

Most candidates could calculate specific heat capacity. Fewer showed competency in describing the concept in relation to experimental design and errors.

Question 11

Most candidates recognised the two forces (weight and the normal force). Fewer recognised the opposing horizontal forces of equal magnitude.

Question 12

Many candidates had difficulty demonstrating a good understanding of expansion in metals and the kinetic theory of solids.

Question 13
This question could be solved by a variety of methods. Many candidates dealt successfully with the 80% kinetic energy.

Question 14
This involved a harder concept. Many candidates failed to recognise that this situation involved a resultant force, and few could explain that the acceleration of the lift downwards assisted gravity, reducing the resultant force (and apparent weight of the suitcase).

Question 15
Most candidates were able to explain that 'non-ohmic' meant that conductor did not follow Ohm's Law. Few could follow through with an adequate explanation of what this actually meant, in terms of the relationship between potential difference and current in non-ohmic resistors.

Question 16
In general, candidates' answers lacked the depth of understanding needed to answer this question. Most candidates realised that a difference in charge attracted the paper to the pen, but most thought this must be because the pen and paper had opposite charges (e.g. the pen was negative so the paper had a positive charge). There was some understanding of charge being equalised and hence repulsion so the paper dropped back down.

Question 17
Most attempted this question on graphical interpretation and it was done well generally.

Section Two: Problem-solving
Question 18
Generally, this question was well done by candidates. A few issues were apparent in part (a) where candidates needed to interpret information explaining a milliamp hour and then perform a calculation and in part (d) involving relationships between potential different and current. Candidates tended to demonstrate conceptual misunderstanding about charge, potential difference, current and globe brightness.

Question 19
Part (a) required candidates to understand the difference between force acting on a small nut and a larger bolt and acceleration due to gravity. Part (b), involving straightforward calculations using equations of motion, was well done. Part (c) was done poorly. This was a motion calculation requiring several steps and these were not handled well.

Question 20
Most candidates knew that the device in the circuit should be an ammeter in part (a), though why an ammeter should be in this position was explained poorly. Parts (b) and (c)(i) were answered well. Part (c)(ii) was the most difficult part of this question requiring candidates to use several steps to calculate the current through one resistor in parallel. Multiple step questions are not done well generally.

Question 21
In parts (a) and (b)(i) candidates showed that they could balance a nuclear equation. Candidates' written answers to parts (b)(ii) and (c) demonstrated poor interpretation of the information given as well as a poor understanding of the processes of nuclear decay and half-life (although question 5 demonstrated candidates can calculate simple half-life). Parts (d) and (e) where straightforward and answered well.

Question 22
In parts (a) and (b) of this question, the calculations were done well. To calculate the power for part (c) many candidates used E_k/t rather than $P = Fv$, which was the appropriate equation for this question. Parts (d) and (e) were written explanations using Newtons' Laws and these were not done well, with most responses lacking the depth of understanding required. A common response to parts (d) and (e) was 'no attempt'.

Question 23
Candidates demonstrated a general lack of understanding of experimental design, heat concepts and definitions. The highly scaffolded calculation was handled reasonably. In part (b) discussions of experimental errors and possible improvements were done poorly. In part (c) candidates had difficulty in defining 'Heat' and 'Temperature'.

Section Three: Comprehension
Question 24
In part (a), some candidates could not explain that the difference between thermal power and electrical power was due to heat lost to the environment. Surprisingly some candidates in part (b) circled the clearly labelled reactor instead of the sections that would be the same in a diesel-fuelled power station. In part (c), few candidates demonstrated an understanding of neutron-induced fission and the role of control rods in the nuclear power station. Candidates demonstrated a good understanding of the advantages and disadvantages of nuclear power plants in part (d). The last two parts, calculations on $P = VI$ and $E = Pt$ were handled well as was part (f ii) $E = mc^2$.