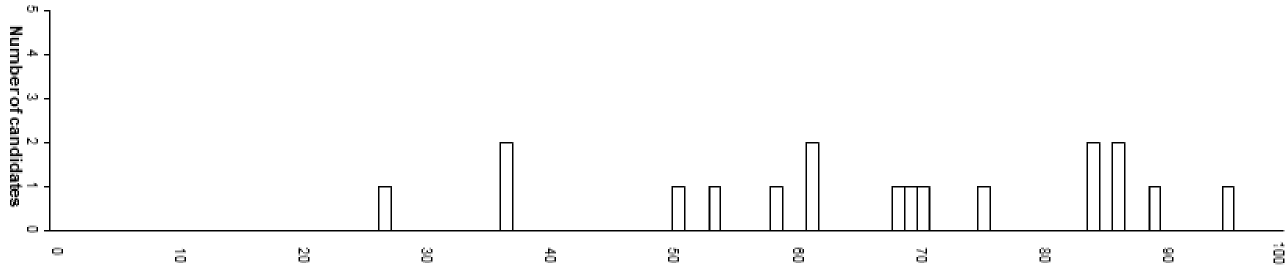
Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

Report on the 2014 WACE examination in
Physics Stage 2

Year	Number who sat	Number of absentees
2014	18	2
2013	27	1
2012	33	2

Examination score distribution



Summary
Almost all questions were answered by all 18 candidates indicating that the examination was of an appropriate length. Candidates' responses to questions suggested they had time to compose their answers and were not rushed.

The overall mean of the paper was 67%. This was a little lower than in 2013, which had a mean of 68%, but is the same as in 2012. With a range of marks for the paper from 23% to 96% the paper was a good discriminator despite the small candidature. The mean for Section One: Short Answer was 71%, for Section Two: Problem-solving the mean was 67% and for Section Three: Comprehension the mean was 64%.

General Comment
The examination covered Units 2A and 2B equally. There was a good balance of questions from each unit across each of the three sections.

Markers noted that most written responses were handled adequately although more complex questions on heat transfer were not answered well. Most candidates who arrived at a correctly calculated answer had set out their calculations clearly, and many were able to handle multiple step calculations.

In general, answers to questions that related to experiments and investigations involving graphing also revealed satisfactory understanding, except of experimental error. Many candidates found the comprehension section to be difficult, suggesting a need for more practise in this area.

A few candidates gave exceptionally good answers. It was generally felt that this was a suitable paper for a well-prepared Stage 2 candidate.

Advice for candidates
- Read the question carefully, noting both what is required and the mark allocation.
- In calculation questions, a mark is often allocated for each different step involved in answering the question.
- When giving written responses, note the mark allocation and ensure that you have a different, valid point for each mark allocated. Remember that you are discussing the physics involved so be specific rather than giving general statements.

- When drawing diagrams, ensure that they are large, neat and labelled clearly.
- Ensure that all working is shown in calculations because marks are awarded for demonstrating understanding as well as for obtaining the correct answer.
- Ensure that you practise applying the kinetic theory to situations involving heating, cooling and expansion. This is tested regularly but is usually not well handled.

Advice for teachers

- Teachers should encourage their candidates to read the syllabus statements while preparing for the examination.
- The 'Working in Physics' section of the syllabus is examinable. Candidates should be given time in class to applying experimental methods, determining absolute error, interpreting sources of error and plotting and interpreting graphical data.
- Section Three: Comprehension often has the lowest mean so candidates should be given practise in assessment tasks involving comprehension style questions.

Comments on specific sections and questions

Section One: Short Answers

Attempted by 18 Candidates   Mean 28.33(/40) Max 38.79   Min 11.52

Question 1 Attempted by 18 Candidates   Mean 3.72(/4) Max 4   Min 2.5
This question on drawing and labelling vector diagrams, and then determining the displacement, was very well handled.

Question 2 Attempted by 17 Candidates   Mean 2.65(/4) Max 4   Min 0
This was expected to be an easy question. The most common error was a failure to draw the correct number of protons and neutrons; also, some diagrams were very small and poorly labelled.

Question 3 Attempted by 18 Candidates   Mean 3.33(/5) Max 5   Min 1
Candidates generally knew the correct position to place an ammeter and a voltmeter within a complex circuit but failed to label the positive and negative sides of each meter correctly.

Question 4 Attempted by 16 Candidates   Mean 2.12(/3) Max 3   Min 0
It was pleasing to see that most candidates determined correctly the energy released from a nuclear equation when given the atomic mass units suggesting a good understanding of mass defect and binding energy in this situation. This was not the case for a similar, but more complex question, in Question 23.

Question 5 Attempted by 18 Candidates   Mean 1.78(/3) Max 3   Min 0
Most candidates recognised that spheres of different charges would attract but had more difficulty in determining the actual value on the charges after they touched and then separated.

Question 6 Attempted by 18 Candidates   Mean 2.67(/3) Max 3   Min 0
Determining half-life from a graph was handled well by most candidates.

Question 7 Attempted by 18 Candidates   Mean 2.67(/4) Max 4   Min 0.5
Many candidates failed to determine the charge of a number of electrons and then use this value in their calculation.

Question 8 Attempted by 18 Candidates   Mean 3.64(/4) Max 4   Min 2.5
This question on equations of motion was answered well. The main error was in not subtracting the length of runway remaining after the plane had lifted off. This may well have been due to not reading the question carefully.

Question 9 Attempted by 18 Candidates   Mean 2.72(/4) Max 4   Min 0
Many candidates selected the incorrect second choice that the lamps in a circuit were the same brightness with the reasoning that as the lamps were identical they had the same resistance

and therefore the same brightness. These candidates either did not notice, or did not understand, that the wire's resistance, in this case, would affect the brightness of Lamp B.

Question 10 Attempted by 17 Candidates   Mean 1.82(/3) Max 3   Min 0
Many candidates seemed not to have read the question carefully, since many discussed each type of radiation rather than applying their knowledge of radiation to the specific situation discussed in the question.

Question 11 Attempted by 18 Candidates   Mean 2.72(/4) Max 4   Min 1
This True/False question on statements taken directly from the syllabus statement was not handled as well as expected.

Question 12 Attempted by 18 Candidates   Mean 2.83(/4) Max 4   Min 1
Uncertainty in measurement was handled relatively well but candidates' responses indicate a need to investigate this area fully during practical activities and in assessments.

Question 13 Attempted by 14 Candidates   Mean 2.71(/3) Max 3   Min 0
This was generally answered well. Some candidates used an equation of motion to determine the speed of a person stepping off a bridge rather than considering an equation related to conservation of motion as instructed in the question.

Question 14 Attempted by 16 Candidates   Mean 2.06(/3) Max 3   Min 0
This question required candidates to apply the kinetic theory to the expansion of joints in a bridge. Many could discuss in a general way why the bridge expanded but typically did not refer to the kinetic theory.

Question 15 Attempted by 17 Candidates   Mean 2.00(/3) Max 3   Min 0
This graph of potential difference against current was well handled; most candidates recognised that a resistor became non-ohmic when the line of the graph started to curve. Candidates had different ideas of exactly when the graph started to curve, and the marking key allowed flexibility to deal with this.

Question 16 Attempted by 18 Candidates   Mean 3.56(/4) Max 4   Min 2
This question on absorbed dose and dose equivalent, including knowledge of the correct unit for dose equivalent, was done well.

Question 17 Attempted by 17 Candidates   Mean 1.12(/3) Max 3   Min 0
Although questions involving Newton's Second Law have appeared regularly in previous examinations this was handled poorly. Candidates should point out that the change in momentum, $m(v-u)$, usually cannot be altered, and then combine this with $Ft = m(v-u)$ (a statement of Newton's Second Law) to explain why increasing the time of the change of momentum reduces the force acting.

Question 18 Attempted by 18 Candidates   Mean 4.11(/5) Max 5   Min 1
The majority of candidates recognised the difference between electron and conventional current in a circuit. This more complex circuit question with resisters in series and in parallel was handled well.

Section Two: Problem-solving
Attempted by 18 Candidates   Mean 33.32(/50) Max 47.41   Min 12.93

Question 19 Attempted by 18 Candidates   Mean 13.39(/16)   Max 16   Min 4.5
This question was handled well by candidates. All but one candidate knew the difference between a series and a parallel circuit in (a) and (b). Simple calculations involving Ohm's Law were well handled in (c) and (d). Explaining which of two components had the greater power was generally answered through calculations, rather than the expected written response, so it was not possible to determine whether or not candidates actually understood the theory behind this question. A simple calculation on power, in (f), was also handled well.

Question 20 Attempted by 18 Candidates Mean 8.39(/18) Max 16.5 Min 2.5
This question involved heating and cooling calculations and written responses on the theory involved proved difficult. Many candidates, surprisingly, were unable to define the term 'internal energy' in (a). This should have been simple recall. A simple specific heat capacity calculation in (b) was done well. An explanation of why blowing on the surface of tea would cool it in (c) was answered poorly with few candidates realising this involved evaporation of the tea and lowering of the average kinetic energy of its particles. Some candidates either did not understand or simply misread (d) and (e), perhaps misunderstanding the term 'iced tea'. They worked a calculation on latent heat in (d) but then did not include the latent heat in their response to (e). The heat transfer question, (f), was answered well.

Question 21 Attempted by 18 Candidates Mean 8.47(/13) Max 13 Min 0
Most candidates demonstrated a sound understanding of completing nuclear equations, atomic number and mass number in (a), could define an isotope in (b) and could calculate the half-life in (c). Determining the binding energy of an alpha particle in (d) proved difficult for many candidates; some confused joules with mega electron volts within the same calculation, while others simply left the question blank.

Question 22 Attempted by 17 Candidates Mean 9.00(/12) Max 12 Min 3
The calculations on determining the power rating of a dishwasher in (a) and relating heat energy and power to find the time of a washing cycle in (b) were generally done well. In (c), where candidates were required to explain why the time calculated in (b) would be longer in real life, many candidates repeated the same general reason in two different ways rather than giving two different reasons. The most common error in (d), on the dangers of a toaster, was in not stating that the metal knife needed to touch a 'live' part of the circuit before a current would flow to the user. Many responses suggested that simply touching the inside of the toaster was enough to produce a current through the user.

Question 23 Attempted by 18 Candidates Mean 12.03(/18) Max 16.5 Min 1
In (a) the free body diagram of forces acting on a rocket during accelerated flight was generally not done well. Some forces were omitted and others were drawn from the rocket at a variety of angles other than the vertical. Labels on vectors were reasonably well attempted. The calculations in (a) to (e) were generally done well with occasional calculation errors or incorrect values for variables.

Question 24 Attempted by 16 Candidates Mean 8.09(/10) Max 10 Min 4.5
Completing a table was well handled in (a) and most candidates used significant figures appropriately. Drawing a graph from the table, in (b), was generally done well; however, a few candidates failed to recognise that the values for time did not increase at an even rate i.e. 2, 4, 5, 8, 10. It was pleasing to see that the calculation of the gradient in (c) was done well.

Section Three: Comprehension
Attempted by 15 Candidates Mean 6.37(/10) Max 9.72 Min 1.39

Question 25 Attempted by 15 Candidates Mean 11.47(/18) Max 17.5 Min 2.5
Using the kinetic theory to explain a phase change in (a) was not done well; as pointed out in the discussion on Question 14, candidates were challenged when required to use the kinetic theory to explain situations involving heating and cooling. The straightforward questions on momentum, (b) and (c), were handled well. Candidates had to extract data from the passage to obtain a mass in tonnes rather than kilograms in (d), which was answered well. A calculation involving conservation of momentum in one dimension in (e) was answered poorly since few candidates recognised that velocity is a vector quantity therefore one direction must be positive and the other negative when completing calculations.