2013 Senior External Examination

Physics
Paper Two — Question book

Time allowed
• Perusal time: 10 minutes
• Working time: 2 hours

Examination materials provided
• Paper Two — Question book
• Paper Two — Resource book
• Paper Two — Response book

Equipment allowed
• QSA-approved equipment
• ruler graduated in millimetres
• non-programmable calculator
• graphing calculator

Paper Two is an open book examination. You may refer to any paper-based material that you have brought into the examination room.

Directions
You may write in this book during perusal time.
Paper Two has six questions that assess Complex reasoning processes. Attempt all questions. Show all working.

Assessment
Paper Two assesses the following assessment criterion:
• Complex reasoning processes

Assessment standards are at the end of this book.

After the examination session
Take this book when you leave.
Planning space
Complex reasoning processes

Paper Two has six questions. Attempt all questions.
Write your responses in the response book. Show all working.

Question 1

Consider the circuit diagram below.

Determine the value of the current at point I and the potential difference between points A and B.

Question 2

Cart A and Cart B are in a race.

If the race is over a distance of 0.50 km, which cart wins?
**Question 3**

The diagram below indicates the passage of a ray of light that is totally internally reflected in a block of transparent material of refractive index $n = 1.5$ sitting in a vacuum.

Total internal reflection occurs for angles of incidence greater than the critical angle, where the angle of refraction (at Point A) equals $90^\circ$.

At what minimum value of $i$ would this occur?

**Question 4**

A shuttle moving material to and from a space station has a mass of 20000 kg. When its rockets are firing, it expels gas from its engines at a velocity of 3000 ms$^{-1}$ at a rate of 50 kgs$^{-1}$.

Assuming the rocket is in space free of gravitational constraints, how fast will it be going after the first second if it has an initial velocity of 0 ms$^{-1}$?

Assuming the engines burn for 10 seconds in total, what will the velocity of the rocket be after this time?

List any significant and relevant assumptions you have made for the purposes of your calculations.

**Question 5**

A javelin thrower is told that the angle to throw a javelin to get the best horizontal distance is 45°. She suspects that she can throw faster at lower angles and therefore achieve a greater distance.

When throwing a javelin at 45°, she can achieve a horizontal distance of approximately 64 m. This is an initial velocity of 25 ms$^{-1}$.

If she can throw fastest at an angle of 38°, what velocity is required at this angle to exceed a distance of 64 m?
Question 6

Two conductors are placed one above the other as shown below.

The bottom conductor is held in place by the brackets and the top is free to move up and down.

Given that each conductor has a mass of 0.1 kg, and that a current of 100 amperes moves through the bottom conductor from left to right as shown in the front view above, what current, and in what direction, is necessary to support the top conductor 1.0 mm above the bottom conductor?

End of Paper Two
### Assessment standards from the Physics Senior External Syllabus 2000 (amended 2003)

#### Paper Two

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Very High Achievement</th>
<th>High Achievement</th>
<th>Sound Achievement</th>
<th>Limited Achievement</th>
<th>Very Limited Achievement</th>
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<tbody>
<tr>
<td>Complex reasoning processes</td>
<td>A high ability to use complex reasoning in challenging situations involving the candidate's understanding of subject matter and a high ability to use scientific processes at an advanced level.</td>
<td>Competence in using complex reasoning in challenging situations involving the candidate's understanding of subject matter and competence in using scientific processes at an advanced level.</td>
<td>Some success in using complex reasoning in challenging situations involving the candidate's understanding of subject matter and some success in using scientific processes at an advanced level.</td>
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