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 **two** parts:

- Part A
- Part B

Show all working.

Suggested time allocation

- Part A: 70 minutes
- Part B: 50 minutes

Assessment

Assessment standards are at the end of this book.

After the examination session

Take this book when you leave.
Planning space
Part A

**Complex reasoning processes.**

Part A has five questions of equal value. Attempt four questions only. Show all working.

Write your responses in the response book.

Suggested time allocation: **70 minutes**.

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**Question 1**

Respond to Question 1 on page 2 of your response book.

A charter boat leaves harbour at 0525 hours. The boat travels 4.5 km E, then 2.5 km S and 1.5 km W before finding a large school of blue-fin tuna at 0725 hours.

Determine the boat’s average speed and average velocity from 0525 hours to 0725 hours, and note any differences.

(Hint: Use the graph paper in the response book.)

**Question 2**

A group of adventurers jump off a clifftop into the sea. Their jumps were timed as follows:

| 3.715 s | 3.718 s | 3.720 s | 3.721 s | 3.729 s |

Find the height of the clifftop above sea level.

**Question 3**

A car can just maintain a speed of 64.8 km/h as it drives up a steady incline of 10°. Find the car engine’s power rating (kW) if the mass of the car is 1.30 tonnes.

(Note: Assume that friction and air resistance are negligible.)

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Part A continues overleaf
**Question 4**

When blue light (\( \lambda = 4.55 \times 10^{-7} \) m) is shone onto a pair of slits separated only slightly, a pattern of bright and dark fringes appears on a screen 2.45 m away. The dark fringes are 5.60 mm apart.

Find the distance between the slits. Describe what would happen if red light (\( \lambda = 6.75 \times 10^{-7} \) m) was used.

**Question 5**

In February 2011 all of the gold in the world was valued at $US 7000 billion, when the gold price was $US 1400 per ounce. If 1 ounce is equivalent to 28.35 grams and gold is 19.3 times as dense as water, calculate the volume of all of the gold in the world in February 2011.

**Note:** 1 billion = \(10^9\). The density of water is \(1000 \text{ kg/m}^3\).

**End of Part A**
Part B

Complex reasoning processes.
Part B has four questions of equal value. Attempt two questions only. Show all working.
Write your responses in the response book.
Suggested time allocation: 50 minutes.

Question 1
A throwing machine used for catching practice at a sports oval has the following settings:

- ball speed: 162 km/h
- angle to the horizontal: 30.0°
- ball height at the point of release: 1.45 m.

If the ground at the oval is completely flat, where should the catcher stand? Justify your response showing full working and stating any assumptions.

Question 2
An auto electrician needs to replace the globes (lamps) in the circuit below.

Find the wattage of these 2.00 Ω globes (L1 and L2).

![Circuit diagram]

Question 3
The Earth is considered to be a uniformly charged sphere of radius 6.37 x 10^6 m. If a 1.00 μC charge feels a downward electrical force of 1.0 x 10^-4 N at the Earth’s surface, find:

a. how many excess electrons are on the Earth’s surface
b. the Earth’s electric field strength.
Question 4

When an engine of the space shuttle’s orbital manoeuvring system exerts a 26700 N force, an amount of fuel negligible to the 95.0 tonne shuttle is used.

Calculate the shuttle’s change in velocity if the force was applied for 4.20 seconds. Can the change in the kinetic energy of the shuttle be calculated using the data given. Justify your response.

End of Part B

End of Paper Two
### Assessment standards from the 2000 senior external syllabus for Physics

**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>
</tr>
</thead>
<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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