EXAMINATIONS COUNCIL OF ZAMBIA
Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

SCIENCE
PAPER 2
(Physics)

Wednesday 4 November 2009 1 hour 15 minutes

Additional materials:
Mathematical tables
Graph paper
Writing paper
(Do not allow calculators)

Time: 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES
Write your name, centre number and candidate number at the top of this page and on any separate answer paper used.

There are twelve (12) questions in this paper.

Section A
Answer all the questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any two questions.
Write your answers on the answer paper provided.

At the end of the examination
1. Fasten answer paper used securely to the question paper.
2. Enter the numbers of the Section B questions you have answered in the grid below.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets [ ] at the end of each question or part question.
Cell phones are not allowed in the Examination room.

<table>
<thead>
<tr>
<th>Candidate’s use</th>
<th>Examiner’s use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A</td>
<td></td>
</tr>
<tr>
<td>Section B</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

This paper consists of 11 printed pages.
1 **Figure 1.1** shows a graph of how the speed of a car changed over 20 seconds as the car accelerated along a straight road.

![Graph showing speed vs time](image)

**Figure 1.1**

(a) Calculate the acceleration of the car.

(b) The mass of the car was 1200kg. Calculate the force which produced the acceleration in (a).

(c) Calculate the distance travelled by the car during the 20 seconds.
2 A girl who has a mass of 50kg runs up some stairs in 7.0 seconds. The stairs are 8.0m high. Take the gravitational field strength as 10N/kg. What is:-

(a) The girl’s weight?

__________________________ [1]

(b) The girl’s potential energy when she is at the top of the stairs?

__________________________ [2]

(c) Her power output?

__________________________ [2]

Total: [5]
3  **Figure 3.1** shows one form of an apparatus used to observe Brownian motion of smoke particles in air. A pupil looking through the microscope sees tiny bright specks which he described as "dancing about".

![Figure 3.1](image)

(a) What are the bright specks?

__________________________________________________________________________

__________________________________________________________________________ [1]

(b) Why are the specks "dancing about"?

__________________________________________________________________________

__________________________________________________________________________ [1]

(c) State the conclusion that can be drawn from Brownian motion.

__________________________________________________________________________

__________________________________________________________________________ [1]

**Total:** [3]
4 (a) Figure 4.1 shows a bus.

Figure 4.1

State 3 modifications that should be made in the design of the bus to make it more stable.

(i) 

(ii) 

(iii) 

[3]

(b) An astronaut with a mass 75kg on Earth travels to the moon whose gravitational field strength is 1.6N/Kg.

(i) What is meant by mass?

[1]

(ii) What is the mass of an astronaut on the moon?

[1]

(iii) What is his weight on the moon?

[1]

Total: [6]
5. **Figure 5.1** shows the diagram of rotating gear wheels. The driving wheel has 36 teeth and the driven wheel has 12 teeth.

![Diagram of gear wheels](image)

**Figure 5.1**

(a) Find the velocity ratio.

\[
\frac{36}{12} = 3
\]

[2]

(b) If the driven wheel makes 15 rotations, how many rotations would the driving wheel make?

\[
15 \times 3 = 45
\]

[2]

Total: [4]

6. **Figure 6.1** shows a ray of light incident on a rectangular glass block. Complete the path taken by the ray of light through and out of the block. The angle of refraction is 18.2°.

![Diagram of light ray](image)

**Figure 6.1**
(b) If the ray strikes the glass block at an angle of 60° as shown in Figure 6.1. Find ...

(i) the angle of incidence. [1]

(ii) the refractive index of the glass block. Use the data below.

\[
\begin{align*}
sin 18.2^\circ &= 0.3125 \\
sin 30^\circ &= 0.500 \\
sin 45^\circ &= 0.707 \\
sin 60^\circ &= 0.866.
\end{align*}
\]

[2]

Total: [5]

7 Figure 7.1 shows how the temperature of two identical cans, one with polished surface and the other one with black painted surface, varied over a short period of time after they were placed into strong sunlight.

(a) State the name of the process that transfers energy to the cans. [1]

(b) Which Can A or B is with the polished surface? [1]

(c) Give a reason for your answer. [1]

Total: [3]
8 Figure 8.1 shows the diagram of a simple a.c generator.

Figure 8.1

(a) Name the parts labelled X and Y.

X  [1]

Y  [1]

(b) Name three ways in which the generator would be made to produce more voltage.

(i)  

(ii)  

(iii)  [3]

Total: [5]
(a) Figure 9.1 shows a network of resistors.

![Resistor Network Diagram]

**Figure 9.1**

(i) What current flows in the 6Ω resistor?

(ii) What charge passes through the 6Ω resistor for 3 seconds.

(iii) What is the potential difference across the 6Ω resistor.

(b) A 2kW, 250V electric fire is connected to 250V mains.

(i) How much current does the electric fire take?

(ii) What is the cost of running the electric fire for 5 hours if the cost of a unit (kWh) of electrical energy is K900?

Total: [8]
Section B
[20 marks]

Answer any two (2) questions from this section.
Use the answer paper provided.

10 In an experiment to determine the half-life of radon-220, the following results were obtained, after allowing for the background count:

<table>
<thead>
<tr>
<th>Time/s</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count rate/5^-1</td>
<td>30</td>
<td>26</td>
<td>23</td>
<td>21</td>
<td>18</td>
<td>16</td>
<td>14</td>
<td>12</td>
</tr>
</tbody>
</table>

(a) By plotting the graph of the count rate (vertically) against time (horizontally), determine the half-life of $^{220}\text{Rn}$. Show clearly on the graph how you obtained the answer. [6]

(b) What is the origin of the background count? [2]

(c) $^{220}\text{Rn}$ emits alpha particle. When it does so, it becomes an isotope of an element polonium (Po). Write an equation to represent this change. [2]

Total: [10]

11 (a) Describe an experiment you would perform to determine the focal length of a converging lens using a distant object. [5]

(b) An object 2cm high is placed 30cm from a converging lens of focal length 10cm. Find by scale drawing the position and size of the image. [5]

Total: [10]
**Figure 12.1** represents a transformer with a primary coil of 400 turns and a secondary coil of 200 turns.

(a) The primary coil is connected to the 240V a.c mains. Calculate the secondary voltage.

(b) Explain carefully how the transformer works.

(c) Why is soft iron used for the core instead of steel?

(d) If the current in the primary coil is 3A, calculate the current in the secondary coil of the transformer, assuming the transformer is 100% efficient.

Total: [10]
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