| Centre Number | Examination Number |
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7300359

# EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

# Physics 5054/2

## Paper 2

**Tuesday** **14 JULY 2026**

Additional Materials:
Electronic calculator (non-programmable)

**Time: 2 hours** **Marks: 80**

### Instructions to Candidates

1 Write the **centre number** and your **examination number** in the spaces provided on this page.

2 Write your **examination number** in the spaces provided on **every page** of this question paper.

3 There are two sections, **A** and **B**.

4 **Section A:** Answer **all** questions. Write your answers in the spaces provided in this question paper.

5 **Section B:**

**(i)** There are **four** questions in this section. Answer any **three**.

**(ii)** Write your answers in the spaces provided within this question paper.

**(iii)** Enter the numbers of the questions you have answered from **Section B** in the grid provided under column '**For Candidate's use**'.

### Information for Candidates

1 The number of marks is given in brackets [ ] at the end of each question or part question. Candidates are reminded that all quantitative answers should include appropriate units and accuracy.

2 Candidates are advised to **show all their working** in a clear and orderly manner, as marks are awarded for correct working and for correct answers.

3 Cell phones are **not allowed** in the examination room.

| | *For Examiners' Use* | |
|---|---|---|
| *For Candidate's Use* | Mark Obtained | Examiner's Initials |
| Section A | | |
| 1 | | |
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| 3 | | |
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| Section B | | |
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**Section A [50 MARKS]**

**Answer all the questions in the spaces provided in this question paper.**

**1** **Figure 1.1** shows a Vernier calliper used to measure the internal diameter of a metallic tin.

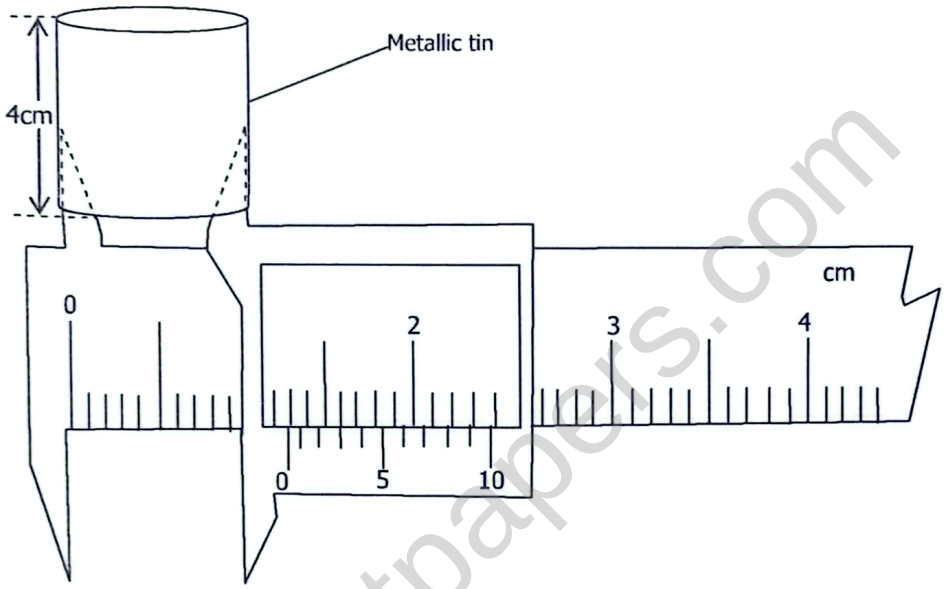


**Figure 1.1**

**(a)** What is the reading for the internal diameter of the metallic tin?

..... [1]

**(b)** Taking the value of $\pi$ as $\frac{22}{7}$, calculate the volume of the tin.

Volume = ..... [2]

(c) (i) The metallic tin was completely filled with an unknown liquid and the mass of the liquid was determined according to **Figure 1.2** and **Figure 1.3**.

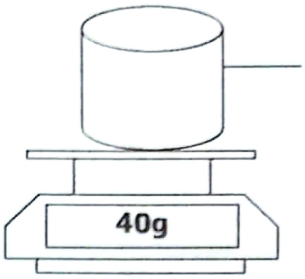


**Figure 1.2 Mass of tin**

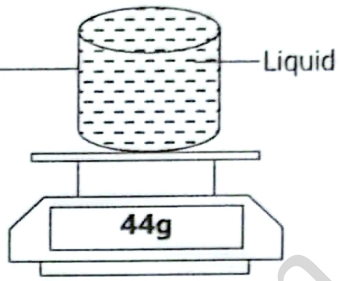


**Figure 1.3 Mass of tin and liquid**

(i) Determine the density of the liquid.

Density = ..... [2]

(ii) **Table 1.1** shows density of three different liquids.

**Table 1.1**

| **Liquid** | **Density/(g/cm$^3$)** |
|---|---|
| Alcohol | 0.81 |
| Paraffin | 0.84 |
| Petrol | 0.79 |

Use the information in **Table 1.1** to identify the liquid.

..... [1]

**[Total: 6 marks]**

| Examination Number | | | | | | | | | | | | | | |
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2 **Figure 2.1** shows a stone of mass 200g released from stretched catapults. The stone moves with constant velocity of 10m/s and hits a bird sitting on a wall fence with a force of 10N. The stone gets lodged into the bird and the velocity reduces to 4m/s in 0.12s. The two move together at a constant velocity of 4m/s until falling off the wall fence through a distance of 1m in 0.5s.

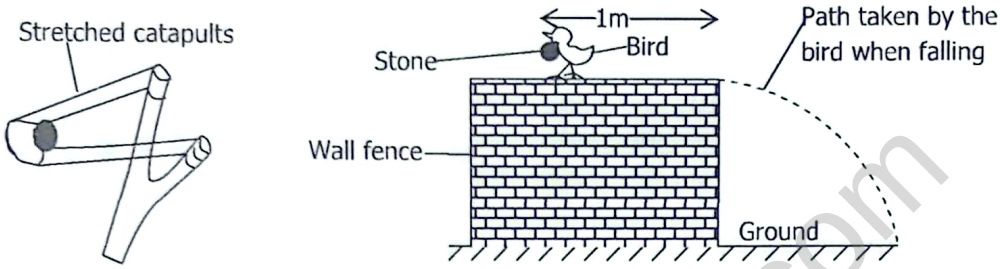


**Figure 2.1** (not drawn to scale)

**(a)** Define force

.....

..... [1]

**(b)** Calculate the

**(i)** energy with which the stone hits the bird.

Energy =..... [2]

**(ii)** deceleration of the stone after it hits the bird.

Deceleration =..... [2]

**(c)** What is the power of the stone as it moves the bird through the distance of 1m on the wall fence?

Power = ..... [2]

**(d)** Why is the path taken by the bird on falling to the ground parabolic?

.....

..... [1]

**[Total: 8 marks]**

3 **Figure 3.1** shows solar panels positioned on the roof of a house. The panels use thermal energy from the sun to provide heat for heating the water supplied to the house.

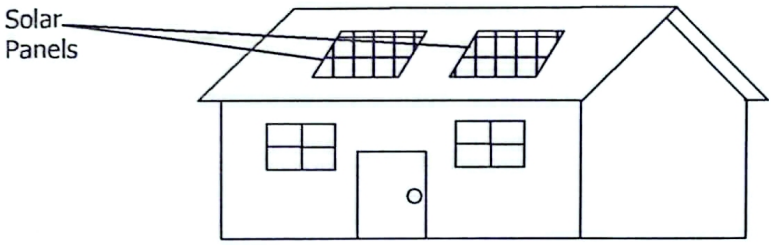


**Figure 3.1**

During day light, the panels are able to heat 5kg of water from a temperature of 20°C to 60°C in 12 hours.

**(a)** State the law of conservation of energy.

.....

..... [1]

**(b)** The solar energy is incident on the panels during this heating period at a rate of 250W. Calculate the solar energy incident on the panels in one hour.

Solar energy..... [1]

**(c)** Calculate the energy that the solar panels deliver to the water in one hour (specific heat capacity of water = 4 200J/kg °C.)

Energy..... [2]

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**(d)** Calculate the efficiency of the solar panels

Energy..... [2]

**[Total: 6 marks]**

**4** **Figure 4.1** shows a plastic ball loosely attached by a rope to a weight resting at the bottom of a river. Water waves on the surface of the river cause the ball to move vertically up and down.

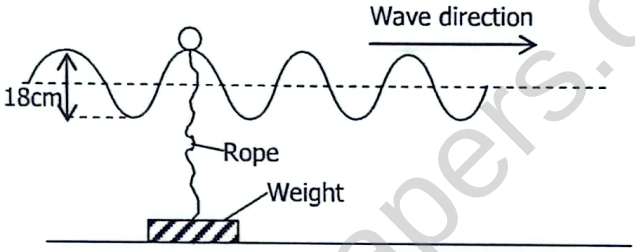


**Figure 4.1**

**(a)** On **Figure 4.1**, label the wavelength. [1]

**(b)** Determine the amplitude of the waves.

Amplitude = ..... [1]

**(c)** The ball reaches it's maximum height 16 times in 1 minute. Calculate the frequency of the waves.

Frequency = ..... [2]

**(d)** Explain how the motion of the ball shows that the water waves are transverse.

.....

..... [1]

**(e)** State **one** other example of transverse waves.

.....

..... [1]

**[Total: 6 marks]**

**5** Ultrasonic waves are sound waves of high frequencies above 20kHz. Ultrasonic waves have characteristics that make them useful in various ways.

**(a)** State the difference between ultrasonic waves and infrasonic waves in terms of frequency.

.....

.....

.....

..... [1]

**(b)** Describe how ultrasonic waves are used in ultrasound imaging when scanning body tissues.

.....

.....

.....

..... [1]

**(c)** Why are ultrasonic waves better than x-rays when used in medicine?

.....

..... [1]

**(d)** The captain of a fishing boat uses an echo to determine the depth of a shoal of fish below the boat. The reflected waves return from the shoal of fish and the sea bed after 0.20s and 0.25s respectively. (Take the speed of sound in water to be 1 500m/s)

Determine the height of the shoal of fish from the sea bed.

Height = ..... [3]

**[Total: 6 marks]**

Examination Number

6 (a) **Figure 6.1** shows a virtual image, **I**, formed by a plane mirror as seen by an observer.

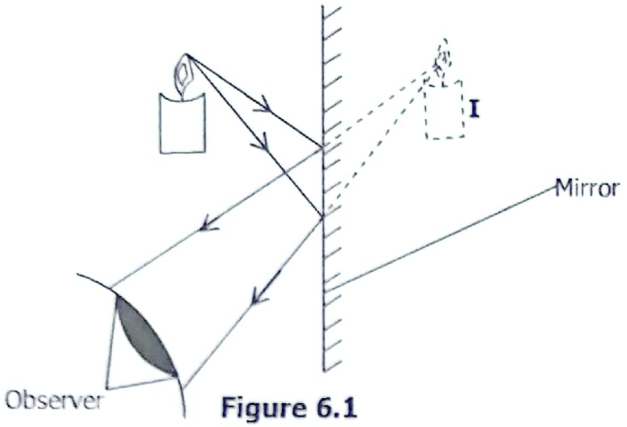


**Figure 6.1**

(i) Explain the meaning of the term virtual image.

.....

..... [1]

(ii) State **one** other characteristic of image **I**.

..... [1]

(iii) Give **one** use of reflection of light.

..... [1]

(b) Light rays change direction when they pass through some materials such as glass. This change in direction is called refraction.

(i) Explain why light changes direction as it passes through glass from air.

.....

..... [1]

(ii) **Figure 6.2** shows a ray of light incident on a transparent glass block from air.

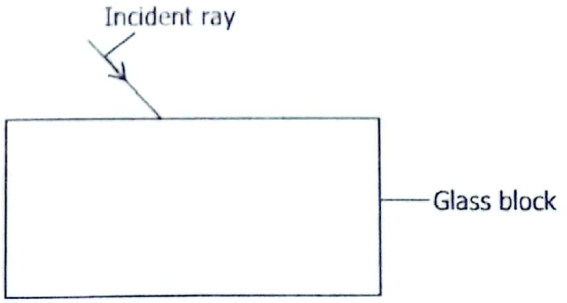


**Figure 6.2**

Complete **figure 6.2** to show the path taken by the ray as it passes through and leaves the glass block. [2]

**[Total: 6 marks]**

7 Electric stoves are usually connected to a 30A fuse located in the fuse box in homes.

**(a)** What is a fuse?

.....

..... [2]

**(b)** Explain why a stove needs a current of 30A to operate normally.

.....

..... [2]

**(c)** Calculate the

**(i)** power when the stove operates at a current of 30A and voltage of 240V

Power = ..... [1]

**(ii)** cost of using the stove for 3 hours if one kilowatt-hour of electricity costs 55 ngwee.

Cost = ..... [1]

**(d)** The stove is earthed when in use. Suggest the importance of earthing.

.....

..... [1]

**[Total: 7 marks]**

8 **Figure 8.1** shows a digital circuit used in electronic systems.

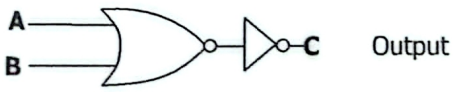


**Figure 8.1**

**(a)** Explain what is meant by the term digital.

.....

..... [1]

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**(b)** In the space provided, draw the truth table for the digital circuit shown in **Figure 8.1**

[2]

**(c)** State the name of a single logic gate whose operation is the same as the digital circuit in **Figure 8.1.**

..... [1]

**(d)** Identify **one** electronic system which uses digital circuits.

..... [1]

**[Total: 5 marks]**

**Section B [30 MARKS]**

**There are four questions in this section. Answer any three questions. Write your answers in the spaces provided in this question paper from page 15 to 22.**

9 **Figure 9.1** shows the braking system used in some cars. The distance between the brake pedal at **X** and the pivot at **Z** is 14cm while the distance between the piston shaft at **Y** and the pivot is 4cm. A force of 200N is applied on the brake pedal.

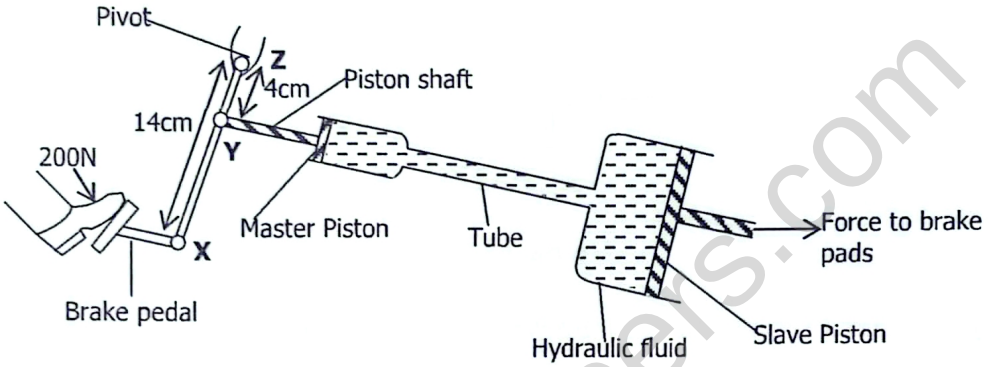


**Figure 9.1**

**(a)** Explain why the distance **XY** is longer than the distance **YZ.** [1]

**(b)** The master piston has a cross-sectional area of $0.02m^2$ while the slave piston has a cross-sectional area of $0.06m^2$

Calculate the

**(i)** force applied on the master piston when the 200N force is applied on the brake pedal, [2]

**(ii)** force that the slave piston applies on the brake pads, [2]

**(iii)** pressure that the slave piston applies on the brake pads. [1]

**(c)** If the braking system in **Figure 9.1** is taken to be 100% efficient, calculate the

**(i)** mechanical advantage of the piston, [2]

**(ii)** the distance moved by the slave piston when the master piston moves 4cm after the 200N force is applied on the brake pedal. [2]

**[Total: 10 marks]**

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**10** **Figure 10.1** shows the arrangement used by a learner to gently heat a 500g sample of solid wax. The heater used to heat the wax is rated 440W. The temperature of the wax is measured every minute.

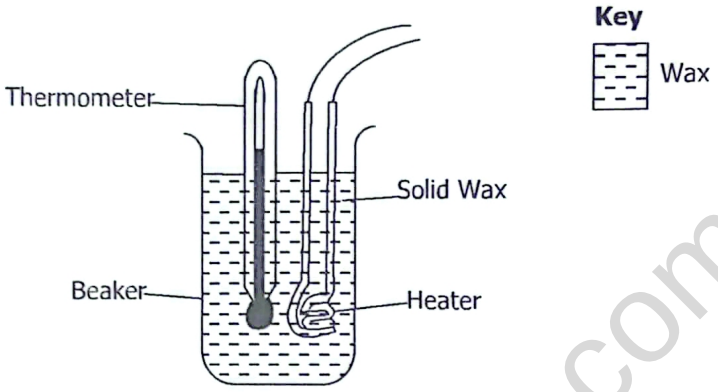


**Figure 10.1**

**(a)** Describe the structure of the solid wax in terms of the arrangement and motion of the wax molecules. [1]

**(b)** **Table 10.1** shows the data collected by the student.

**Table 10.1**

| Time (minutes) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (°C) | 35 | 40 | 45 | 49 | 50 | 50 | 50 | 50 | 50 | 53 | 56 |

Use the data to plot a graph of **temperature** of the wax against **time**, on the graph provided on **page 18**. [3]

**(c)** Using the information provided and the graph obtained, determine the

**(i)** melting point of the wax, [1]

**(ii)** heat gained by the wax during melting, [3]

**(iii)** specific latent heat of fusion of the wax. [2]

**[Total 10 marks]**

11 **Figure 11.1** shows a set-up used by a student to demonstrate electromagnetic induction.

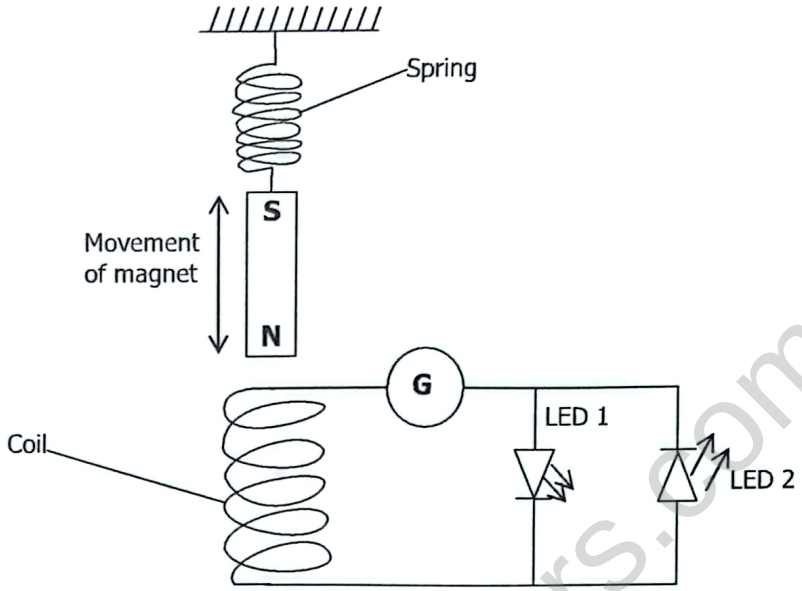


**Figure 11.1**

The coil is connected to two light-emitting diodes (LEDS)
The spring moves the magnet vertically in and out of the coil.

**(a)** Explain why there is induced e.m.f in the coil when the magnet moves. [2]

**(b)** The direction of induced current is determined using Lenz's law.

**(i)** State Lenz's law. [1]

**(ii)** Explain how Lenz's law applies in this experiment. [2]

**(c)** Which LED will light up when the magnet moves into the coil? Explain your answer. [3]

**(d)** The student observes that the brightness of the LEDs is still low despite moving the magnet frequently and faster in and out of the coil.
State two changes the student should make to the apparatus to increase the brightness of the LEDs [2]

**[Total: 10 marks]**

| Examination Number | | | | | | | | | | | | | | |
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12 **Figure 12.1** illustrates a nuclear chain reaction. In a chain reaction, the mass defect is large and appears mostly as kinetic energy of the fission fragments.

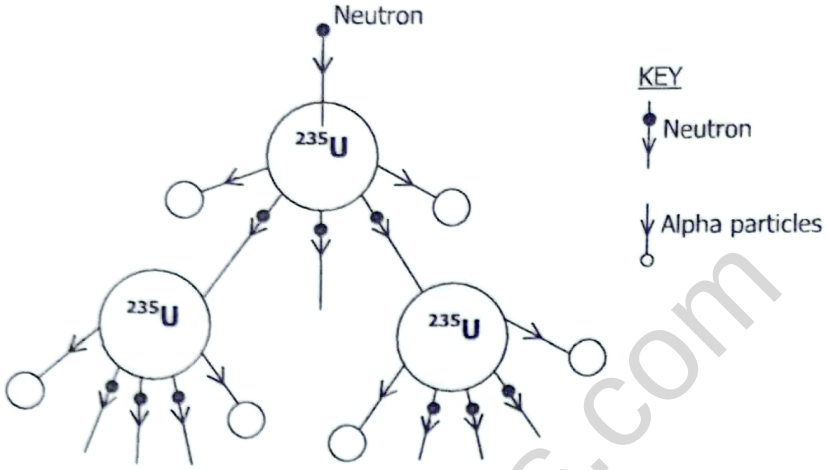


**Figure 12.1**

**(a)** **(i)** Briefly describe how uranium decays in a nuclear reaction. [2]

**(ii)** Write a nuclear equation for the reaction illustrated in **Figure 12.1**. [2]

**(b)** Explain why a large amount of heat is produced in a nuclear reaction. [2]

**(c)** In nuclear power stations, nuclear reactions in nuclear reactors occur at controlled steady rates.

Explain how this is achieved. [1]

**(d)** The Geiger-Muller (G. M.) tube is one of the instruments used in the detection of radiation.

**(i)** Briefly describe how a G.M. tube detects radiation. [2]

**(ii)** State **one** other instrument that is used to detect radiation. [1]

**[Total: 10 marks]**