

**THE UNITED REPUBLIC OF TANZANIA  
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA  
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

**031/1**

**PHYSICS 1**  
(For Both School and Private Candidates)

**Time: 3 Hours**

**Friday, 08<sup>th</sup> November 2019 a.m.**

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**Instructions**

1. This paper consists of sections A, B and C with a total of **eleven (11)** questions.
2. Answer **all** questions in sections A and B and **two (2)** questions from section C.
3. Cellular phones and any unauthorized materials are **not** allowed in the examination room.
4. Non-programmable calculators may be used.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Where necessary the following constants may be used:
  - (i) Acceleration due to gravity,  $g = 10 \text{ m/s}^2$ .
  - (ii) Density of water =  $1.0 \text{ g/cm}^3$ .
  - (iii)  $\pi, \pi = 3.14$ .
  - (iv) Coefficient of linear expansivity of the brick =  $1.2 \times 10^{-5} \text{ K}^{-1}$
  - (v) Speed of light in air =  $3 \times 10^8 \text{ m/s}$ .
  - (vi) Speed of sound in air =  $340 \text{ m/s}$ .

## SECTION A (15 Marks)

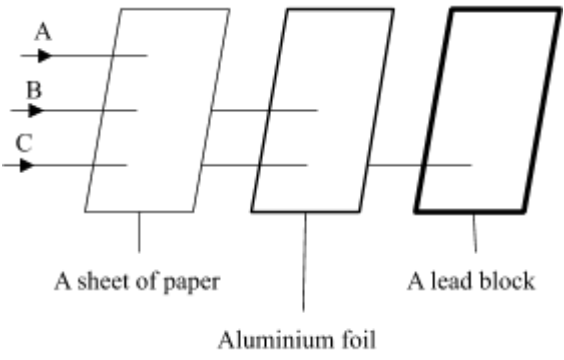
Answer **all** questions in this section.

1. For each of the items (i) - (x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided.

- (i) Which pairs of instruments would you use to correctly measure the diameter of a small ball bearing?
- A Measuring tape and vernier caliper  
B Slide rule and micrometer screw gauge  
C Vernier caliper and slide rule  
D Micrometer screw gauge and vernier caliper  
E Metre rule and micrometer screw gauge
- (ii) A piece of cork of volume  $100 \text{ cm}^3$  is floating on the surface of water. If the density of the cork is  $0.25 \text{ g cm}^{-3}$ , what volume of the cork is immersed in the water?
- A  $100 \text{ cm}^3$                       B  $0.25 \text{ cm}^3$                       C  $25 \text{ cm}^3$   
D  $100.25 \text{ cm}^3$                       E  $0.025 \text{ cm}^3$
- (iii) A layer of colorless water floating on a blue copper (II) sulphate solution becomes blue after sometime. Which physical process supports the observation made?
- A Diffusion                      B Cohesive                      C Surface tension  
D Adhesive                      E Osmosis
- (iv) A pin-hole camera 200 mm long produces an image of 2 mm diameter of the sun. If the sun's distance from the earth is about  $1.5 \times 10^8 \text{ km}$ , what is the diameter of the sun?
- A  $1.5 \times 10^8 \text{ km}$                       B  $1.5 \times 10^6 \text{ km}$                       C  $3 \times 10^5 \text{ km}$   
D  $7.5 \times 10^4 \text{ km}$                       E  $3.0 \times 10^3 \text{ km}$
- (v) Which phenomena is a result of the earth being exactly along the same line between the centre of the sun and the moon?
- A Lunar eclipse                      B Penumbra                      C Solar eclipse  
D Umbra                      E Reflection
- (vi) Which metals become strongly magnetized when subjected to a magnetic field?
- A Nickel and copper                      B Zinc and aluminium                      C Cobalt and iron  
D Aluminium and lead                      E Iron and zinc
- (vii) A body moved upward a distance of 20 m. Calculate the time taken to reach the maximum height.
- A 2 s                      B 5 s                      C 10 s                      D 15 s                      E 11 s

- (viii) The temperature of a certain liquid is measured to be 300K. What will be its temperature in degrees centigrade?
- A 273°C                                      B 100°C                                      C 57°C  
D 37°C                                      E 27°C
- (ix) Which factors influence friction between tyres of a car moving with constant speed and surface of the road?
- A Weight and speed                                      B Speed and nature of the surface  
C Nature of the surface and weight                                      D Surface area of the tires and speed  
E Acceleration and nature of the surface
- (x) When the sun shines on the dark-coloured driving wheel of a car, the wheel feels warm. Why?
- A It is because the sun warms the car by induction.  
B It is because the sun gives energy to the wheel by convection.  
C It is because the sun radiates thermal energy to the wheel.  
D It is because the sun conducts thermal energy to the wheel.  
E It is because the sun conducts thermal energy to the wheel.

2. Match the properties of radiations in **List A** with the corresponding radiations in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided. The responses might be used more than once.

List A	List B
<p>(i) Has weak-moderate ionising power.</p> <p>(ii) Is deflected towards south pole of the magnet.</p> <p>(iii) Has high penetrating power but stopped by lead sheet.</p> <p>(iv) Has the least penetrating power but stopped by a sheet of paper.</p> <p>(v) Has a speed up to 10% times the speed of light in vacuum.</p>	 <p>A sheet of paper                                      Aluminium foil                                      A lead block</p>

## SECTION B (60 Marks)

Answer **all** questions in this section.

3. (a) In a light experiment, a narrow beam of light directed onto a glass prism leaves the prism and falls on a white screen. Draw a labelled diagram to show the experimental set-up and observation seen on a screen. **(5 marks)**
- (b) Explain two ways in which lens cameras differ from the human eye. **(5 marks)**
4. (a) Why a bubble of air increases in volume as it rises from the bottom of a pond of water to the surface? Briefly explain. **(5 marks)**
- (b) A half meter rule AB is freely pivoted at 18 cm from end A and balances horizontally when a body of mass 35 g is hung 48 cm from end B. Calculate the mass of the rule. **(5 marks)**
5. (a) Figure 1 shows a simple machine B which has to be used to pull the packing case of 2000 N into the car by an effort of 500 N. Calculate the efficiency of machine B. **(5 marks)**

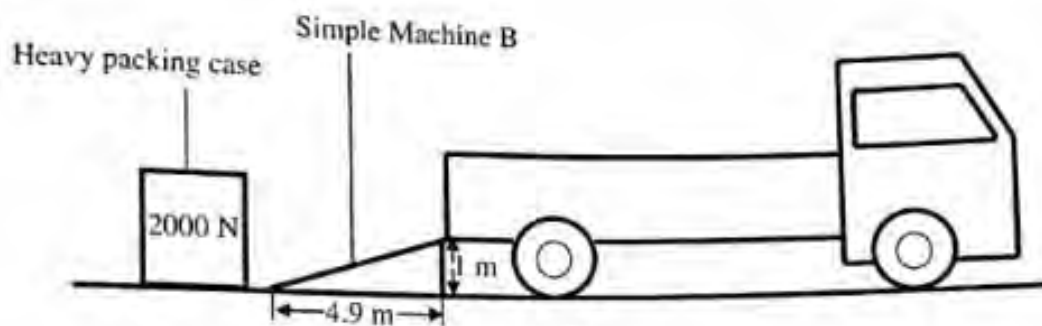


Figure 1

- (b) With the aid of a clearly labelled diagram, describe an experiment to investigate the relationship between the force acting on a body and the acceleration produced. **(5 marks)**
6. (a) A beaker containing ice is heated from  $-5^{\circ}\text{C}$  to  $0^{\circ}\text{C}$  and then from  $0^{\circ}\text{C}$  to  $15^{\circ}\text{C}$ . With the aid of a diagram, explain the variation of density with temperature. **(5 marks)**
- (b) A brick at  $20^{\circ}\text{C}$  has a dimension of 30 cm, 18 cm and 10 cm for length, width and height respectively. If a brick is heated to a new temperature of  $150^{\circ}\text{C}$ , calculate the new dimensions. **(5 marks)**

7. (a) With the aid of a diagram, explain the function of a fuse in an electrical appliance. **(5 marks)**
- (b) A circuit in a house is protected by a 10 A fuse. The circuit is connected to the 240 V mains. The following appliances are connected to the circuit:

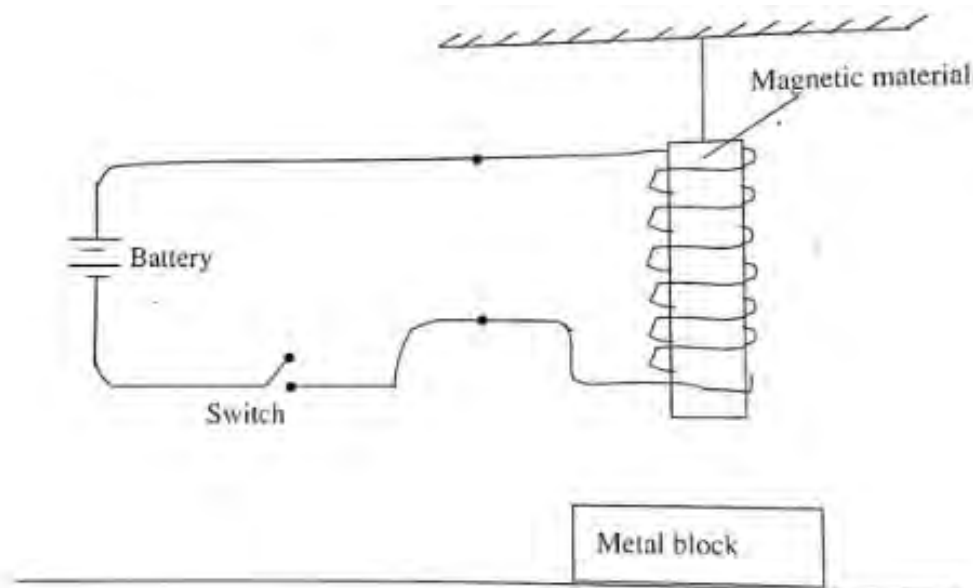
Appliance	Power rating
Bulb 1	100 W
Bulb 2	75 W
TV	300 W
Heater	1500 W

- Determine whether the fuse will blow on or off if all appliances are turned on. **(5 marks)**
8. (a) Why the inner core of the earth is solid while the outer core is liquid? Briefly explain. **(5 marks)**
- (b) The frequency obtained from a plucked string when the tension is 2 N is 400 Hz. Calculate the frequency when the tension is increased by 6 N. **(5 marks)**

### SECTION C (25 Marks)

Answer **two (2)** question from this section.

9. (a) Carefully study Figure 2 which shows a design for an electrical operation model for lifting metal objects. Briefly explain three things you can do so that a heavier iron metal block can be lifted. **(6 marks)**



**Figure 2**

- (b) Why a musician must retune a stringed instrument if its temperature changes? **(2.5 marks)**
- (c) During a thunderstorm, the time between the flash of light and the thunder is 10 s. How far away is the thunderstorm? **(4 marks)**
10. (a) A sample of carbon isotope  $^{14}_6\text{C}$  has a half-life of 5700 years. What fraction of  $^{14}_6\text{C}$  will remain after 11400 years? **(6 marks)**
- (b) Describe the construction and mode of action of the PN junction semiconductor. **(6.5 marks)**
11. (a) Electrical energy is distributed in all parts of Tanzania by the National grid system which transmits alternating current at a very high voltage. Explain why is it necessary to have a very high voltage? **(5.5 marks)**
- (b) A generator producing a varying current from 0 to 10 A was allowed to flow in a coil of magnetic field. After a time interval the current was observed to be 4 A. Describe how back e.m.f. Was induced in a self-induction. **(7 marks)**

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**031/2A**

**PHYSICS 2A  
ACTUAL PRACTICAL A  
(For Both School and Private Candidates)**

**Time: 2:30 Hours**

**Thursday, 14<sup>th</sup> November 2019 a.m.**

**Instructions**

1. This paper consists of **two (2)** questions. Answer **all** the questions.
2. Each question carries 25 marks.
3. Non-programmable calculators may be used.
4. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

The following information may be useful:

Pie,  $\pi = 3.14$

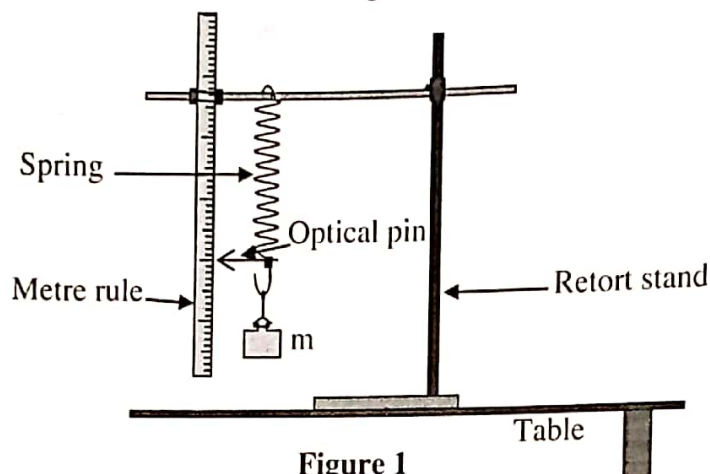
Acceleration due to gravity,  $g = 10 \text{ m/s}^2$ .



1. The aim of this experiment is to determine the density of a liquid L by means of a spiral spring.

**Proceed as follows:**

- (a) Assemble the apparatuses as shown in Figure 1 with zero mark of the meter rule at upper most end. Record the reading of the position of a pointer on the scale as  $y_0$ .



- (b) Hang the 50 g mass on the spring and record the reading on the metre rule as  $y$ . Find the extension,  $e = y - y_0$ .
- (c) Without removing the 50 g mass, repeat the procedure in 1 (b) for  $m = 100$  g, 150 g, 200 g and 250 g mass to obtain a total of five readings. Remember to calculate the extension,  $e$  in each observation.
- (d) Measure and record the mass of empty piece of bottle labelled Q.
- (e) Replace the masses with a piece of bottle labelled Q filled with  $100 \text{ cm}^3$  of liquid L. Record the resulting extension as  $e_1$ .

### Questions

- (i) Prepare a table of results including the values of  $m$ ,  $y$  and  $e$ .
- (ii) Plot a graph of mass  $m$  (g) against extension  $e$  (cm).
- (iii) Find the gradient  $G$  of the graph.
- (iv) What will be the extension produced by a mass of 1.0 kg?
- (v) Use the information from the graph you have drawn to determine the density of liquid L in its SI units.

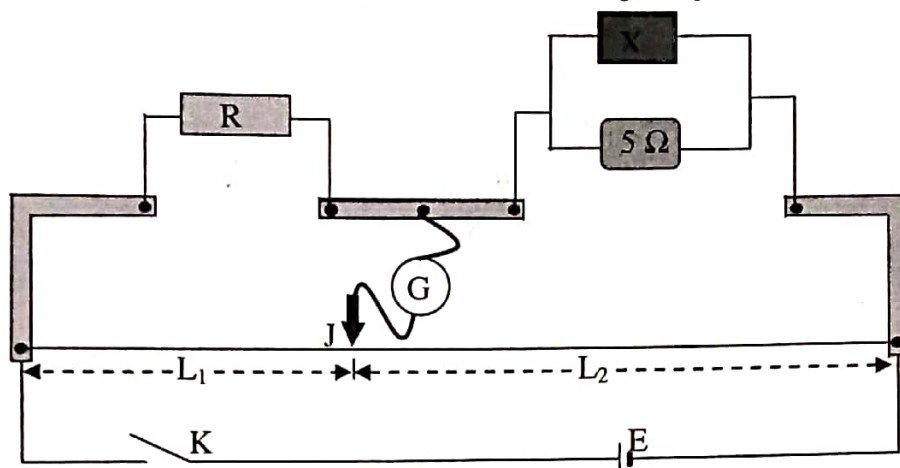
**(25 marks)**



2. You are required to determine the value of unknown resistance  $X$  using metre bridge.

**Proceed as follows:**

- (a) Connect the circuit as shown in Figure 2, where  $R$  is a resistance box,  $E$  is a dry cell,  $K$  is a key,  $G$  is a centre-zero galvanometer,  $J$  is a jockey and  $X$  is unknown resistance.



**Figure 2**

- (b) Set  $R = 1 \Omega$ , close the key  $K$ , slide the jockey over the metre bridge wire until the galvanometer reads zero. Read and record length  $L_1$ . Also read and record the corresponding length  $L_2$ .
- (c) Repeat the procedures in 2 (b) for  $R = 2 \Omega, 3 \Omega, 4 \Omega$  and  $5 \Omega$  and record the value for  $L_1$  and its corresponding value of  $L_2$  in each case.

### Questions

- (i) Tabulate your results including the values of  $\frac{L_1}{L_2}$ .
- (ii) Plot a graph of  $R$  against  $\frac{L_1}{L_2}$ .
- (iii) Deduce the slope,  $S$  of the graph.
- (iv) Find the value of unknown resistance  $X$ . Show clearly how you arrived to your answer.

**(25 marks)**