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

131/3B **PHYSICS 3B**
(PRACTICAL B)
(For Both School and Private Candidates)

Time: 3:20 Hours **Year: 2022**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **Number 1** carries 20 marks and the other **two (2)** carry 15 marks each.
5. Mathematical tables and non-programmable calculators may be used.
6. Cellular phones and any unauthorized materials are **not** allowed in the examination room.
7. 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, $g = 981\ cms^{-2}$

1. Suppose the weighing balance at your school is not working properly and you are required to determine the mass of an empty glass beaker.

Proceed as follows:

(a) Use the masking tape to firmly wrap the thread on the beaker and suspend it to the lower end of the spring as shown in Figure 1 where an optical pin is bent into 'S' shape.

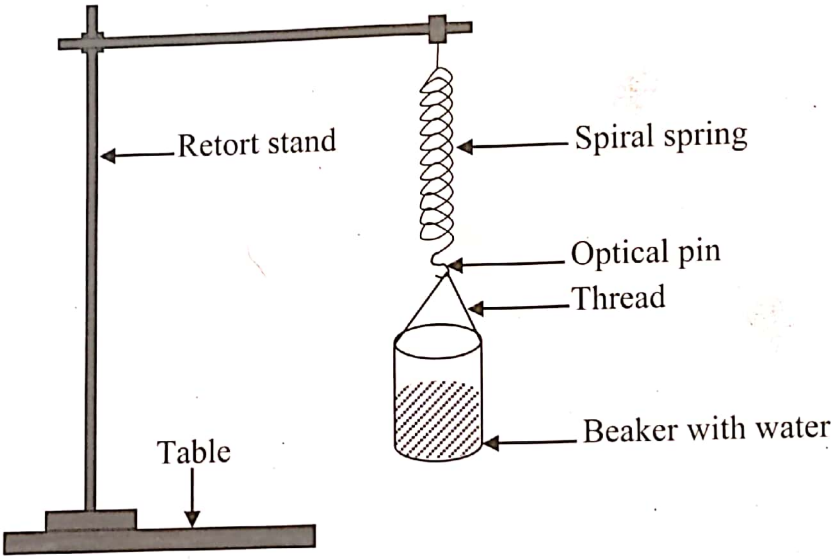

Figure 1

(b) Measure volume, V = 25 cm^3 of water and pour it into the suspended beaker. Gently pull the beaker a small distance downward and release it so that it performs vertical oscillations. Measure and record time t (s) for 30 oscillations and determine its periodic time, T.

(c) Repeat procedures in 1 (b) for V = 60 cm^3, 100 cm^3, 150 cm^3 and 200 cm^3.

Questions

(i) Tabulate your results including values of T^2 (s^2).

(ii) Plot a graph of V (cm^3) against T^2 (s^2).

(iii) Establish the equation governing this experiment.

(iv) Use the graph and the equation obtained in 1 (iii) to determine the mass of an empty glass beaker.

(v) What will happen to the floating object if it is put in oscillating beaker being at the bottom position of its oscillation? Briefly explain.

2. Hotel owner heats water for his customers every morning using electric heaters and noticed that, heat is lost because sometimes customers do not take bath. Therefore, he is aiming to use heat obtained from the heated water for other purposes. Perform an experiment to prove to him that the heated water can also be used to heat other liquids.

Proceed as follows;

(a) Fill the beaker with 100 ml of hot water of about 90 °C.

(b) Pour 50 ml of normal water (at the room temperature) into a calorimeter.

(c) Insert the calorimeter containing normal water into a beaker with hot water of 85 °C placed on a wooden block. Quickly close the beaker with a lid as shown in Figure 2.

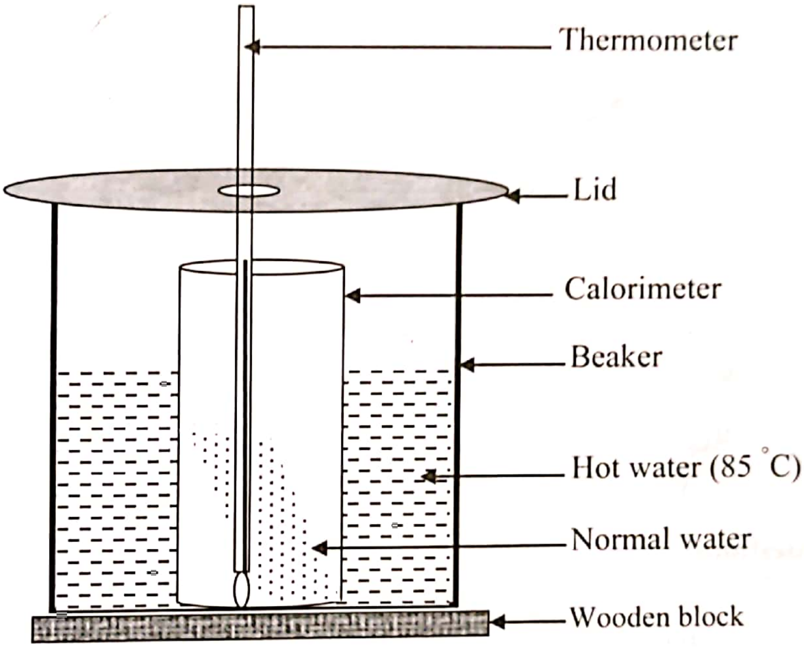

Figure 2

(d) Read and record the temperature of water in the calorimeter for every half minute until the thermometer records about 55 °C.

(e) Empty the calorimeter and the beaker.

(f) Repeat procedures 2 (a) to (d) by filling the calorimeter with 50 ml of **liquid L**.

Questions

(i) Tabulate your results.

(ii) Plot the graphs of temperature against time for water and **liquid L** on the same axes.

(iii) Determine the rate of temperature rise (°C/minute) for water and **liquid L** at 42 °C.

(iv) Suggest any two improvements that will result into increase in the temperature gained by **liquid L**.

3. You are required to investigate the value of the unknown resistance, **R** which was coupled parallel to a wire labelled **W** by means of Wheatstone metre bridge. In order to achieve the task, the following instructions were given:

(a) Connect the standard resistor of 2 Ω in the left hand gap of the Wheatstone metre bridge. The unknown resistance **R** is connected parallel to the wire labelled **W** and placed in the right hand gap, as shown in Figure 3.

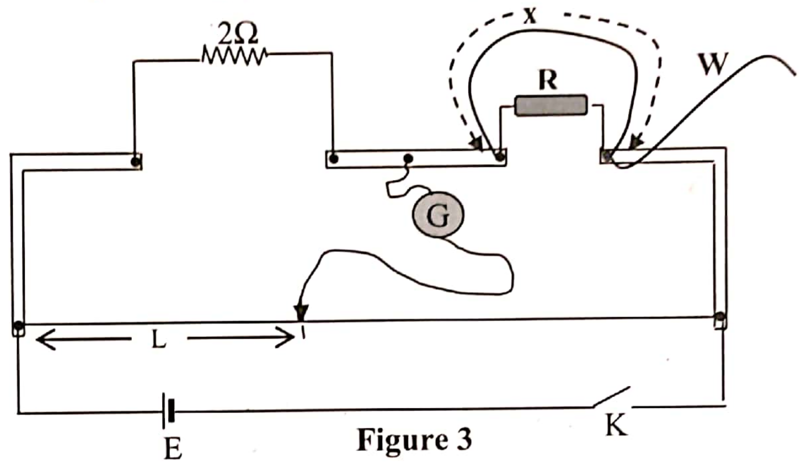

Figure 3

(b) With x = 1.0 m close the switch, K and find the balance point L, then determine the equivalence resistance, R_e.

(c) Repeat the procedure in 3 (b) with x = 0.8 m, 0.6 m, 0.4 m and 0.2 m, determine the corresponding equivalent resistance, R_e in each case.

Questions

(i) Tabulate your results in 3 (b) and (c) including the values of $\frac{1}{x}$ (m^{-1}) and $\frac{1}{R_e}$ (Ω^{-1}).

(ii) Plot a graph of $\frac{1}{x}$ (m^{-1}) against $\frac{1}{R_e}$ (Ω^{-1}).

(iii) Determine the slope S.

(iv) Deduce an equation that governs this experiment.

(v) Compute the value of the unknown resistance, **R**.

(vi) Determine the specific resistance of the given wire, **W**.