THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

731/2 PHYSICS 2

(ACTUAL PRACTICAL 2)

Time: 3 Hours **Year: 2023**

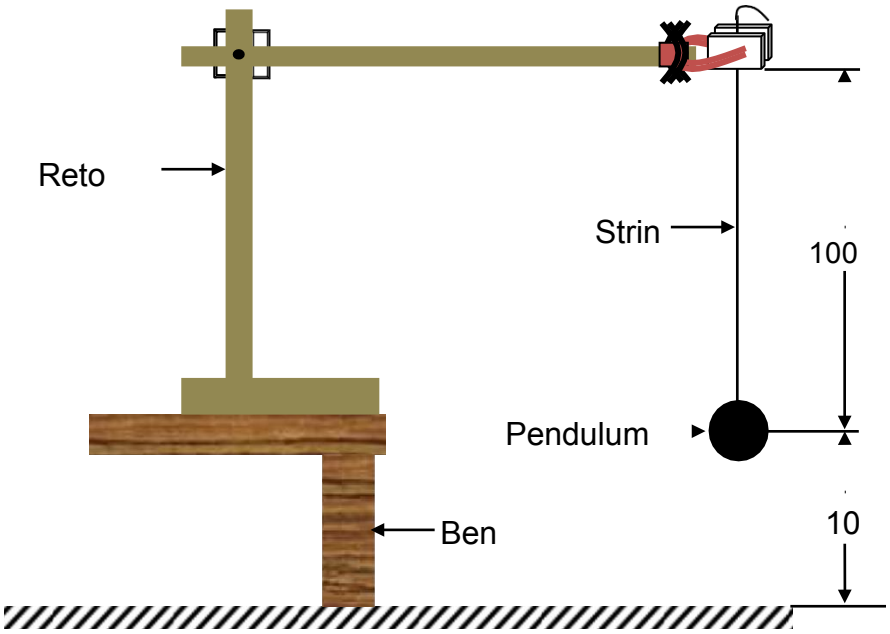
Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question number **one (1)** carries **twenty (20)** marks and the rest carry **fifteen (15)** marks each.
4. Cellular phones and any unauthorized materials are not allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet (s)

1. Suppose you are given an assignment to determine the gravitational pull strength of your school area so that you can be able to determine the weight of objects and you are given the following materials: metre rule, retort stand, stopwatch, inextensible string, pendulum bob and two wooden pads. Conduct the experiment through the following procedures and answer the questions that follow.

   Procedures:

   (a) Fix one end of an inextensible string on the retort stand. Tie a pendulum bob to the other end as shown in **Figure 1.**



(b) Measure the height, (h) = 10 cm from the ground to the centre of mass of the bob.

(c) Slightly displace the bob and release to let it oscillate freely and record the time for 20 complete oscillations.

(d) Repeat procedures in 1(b) to (d) for values of h = 20, 30, 40, 50, 60, 70 and 80 cm.

Questions:

(i) Tabulate the results including the corresponding values of periodic time.

(ii) Plot a graph of h (m) against T2 (sec^2).

(iii) Find the intercept of your graph.

(iv) Determine the slope S of your graph. What does it imply?

(v) What is the value of gravitational pull at your center?

(vi) Suppose the amplitude of vibration diminishes due to increased air resistance, will the periodic time for 20 complete oscillations be different? Briefly explain.

2. In the heating experiment you observed that, when substances made of the same material are exposed at the same initial temperature and then allowed to cool, their rate of cooling differs depending on various factors. Then, you decide to carry out an experiment to investigate the rate of cooling. If you are provided with the following apparatuses and materials: A calorimeter with jacket and stirrer, thermometer, hot water (to be fetched from heat source) and stop watch, perform the experiment through the given procedures and answer the questions that follow.

Procedures:

(a) Weigh and determine the mass of an empty calorimeter (without its outer jacket)

(b) Half fill $\left(\frac{1}{2}\right)$ the calorimeter with hot water about 90^{o}C, and place the calorimeter in its jacket. Place the lid with stirrer and finally insert the thermometer. Wait for the temperature of the water to reach 85^{o}C.

(c) Observe and record the temperature of the contents for every 2 minutes as it cools from 85^{o}C to 50^{o}C. Remove the calorimeter from the jacket and measure the mass of calorimeter with water but without its outer jacket.

(d) Repeat the procedures in 2 (b) and (c) with the calorimeter about three quarter $\left(\frac{3}{4}\right)$ full of water.

Questions:

(i) Tabulate the results for both half and three quarter full including time and temperature for each case.

(ii) Plot the cooling curves for both half and three quarter full in the same frame of axes. (iii) Use the two curves to obtain the ratio $\left(\frac{1}{2}\right)$ full : $\left(\frac{3}{4}\right)$ full of the times taken for both to cool from 85°C to 60°C.

(iii) What conclusion can you draw on the ratio obtained in 2 (iii)? (v) Using your graph, comment how a quantity of a body/substance affects its rate of cooling?

3. You were assigned to install electricity to a new secondary school building. The district electric department provided you with two standard resistors labeled R_1 and R_2 each having 1 Ω, four standard resistors (2 Ω, 3 Ω, 4 Ω and 5 Ω), switch (K), voltmeter (V), ammeter (A) and connecting wires. Design a circuit having two loads labeled R_1 and R_2 connected in such a way that, the voltage drop across the two loads is the same. Following the procedures provided, perform an experiment and then answer the questions that follow.

Procedures:

(a) Complete a design by connecting a switch and two dry cells provided.

(b) Close the switch, K and quickly record the reading on the ammeter and voltmeter.

(c) Replace R_2 with $R_o = 0$ Ω and quickly record simultaneously the reading on the ammeter and voltmeter.

(d) Repeat procedure 3(c) for $R_o = 2$ Ω, 3 Ω, 4Ω and 5 Ω.

Questions

(i) Tabulate your results as shown in the following table:

R_o (Ω)	0	1	2	3	4	5
P.d (V)						
I (A)						

(ii) Draw a well labeled diagram for the experimental set-up.

(iii) Evaluate the validity of the Ohm's law in this experiment.

(iv) Deduce mathematical relation that can be used to evaluate the equivalent resistance (Req) when Ro = 10 Ω.

(v) Plot a graph of P.d (V) against I (A) and then comment on the numerical values of slope and intercept.