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

131/3A

PHYSICS 3A
ALTERNATIVE A PRACTICAL
(For Both School and Private Candidates)

Time: 3 Hours 10 Minutes

Thursday, March 10, 2005 a.m.

Instructions

1. Answer ***all*** questions.
2. Read each question carefully.
3. All calculations must be clearly presented in the answer booklet provided.
4. Mathematical tables, desk calculators and graph papers may be used.
5. Cellular phones are ***not*** allowed in the examination room.
6. Write your ***Examination Number*** on every page of your answer booklet(s).

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This paper consists of 4 printed pages.

1. In this experiment you are required to investigate how the period of the torsional oscillation of a suspended disc depends on the mass m which it carries.

You are provided with two cardboard discs. Each disc has three small holes spaced at regular intervals near the edge. Disc A has pieces of string threaded through the holes as well as disc B.

(a) (i) Clamp disc B horizontally using two small blocks of wood. Suspend disc A vertically below disc B by using strings through the holes as shown in figure 1 below.

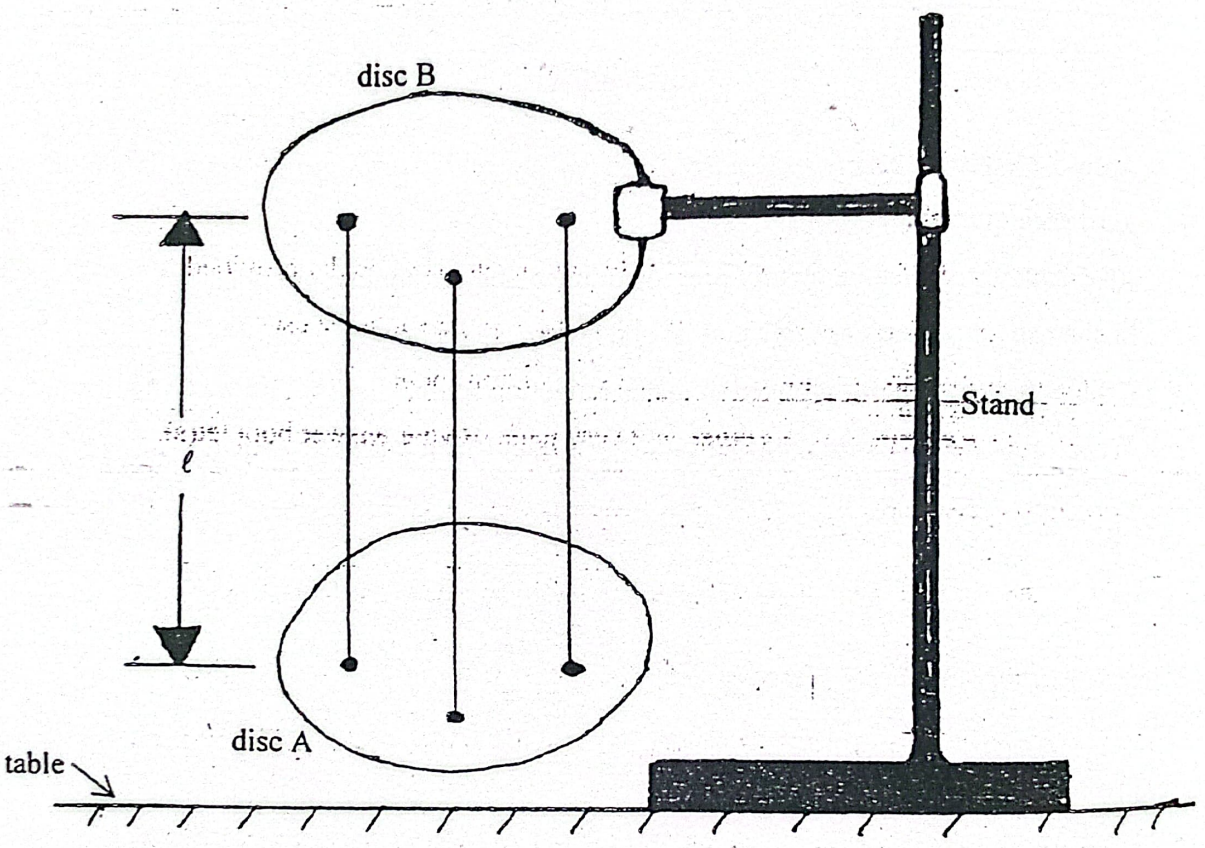

Fig.1

(ii) Place a 50 g mass at the centre of disc A.

(iii) Adjust the length of three strings until $\ell = 100$ cm.

(b) (i) Gently rotate disc A through a small angular displacement and release it so that the disc performs torsional oscillations in horizontal plane as shown in figure 2 below.

(ii) Make and record measurements to determine the period T of these oscillations. Take ten (10) oscillations.

(c) Repeat b(i) and (ii) for different values of M stacking the slotted masses on top of each other until you have six sets of readings on T and M. Include values of log T and log M in your table of results.

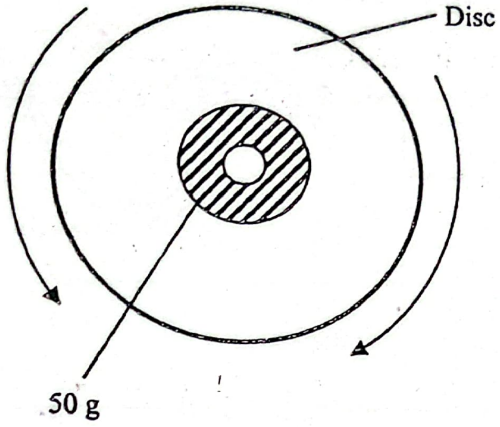

Fig. 2

(d) T and M are related approximately by a simple power law of the form $T = kM^n$

(i) Plot graph of log-T against log M and draw the best line through the points.

(ii) Determine the gradient and intercept of the graph.

(iii) Use your answer from (ii) to calculate the numerical values for n and k.

(e) (i) Replace the masses by an unknown mass M, which has been provided.

(ii) By performing a further measurement and using the results of your experiment determine the mass M.

2. You are required to plot cooling curves for hot water in a calorimeter with the calorimeter about

(a) half full of water

(b) two-thirds full of water.

Proceed as follows:

Half fill a weighed calorimeter with water so that the temperature immediately after this operation is about 65° C. Observe the temperature of the contents at intervals of two minutes as it cools over a temperature range 60° C to 45° C, weigh the calorimeter with water after the experiment.

Repeat the procedure with the calorimeter about two-thirds full of water.

(c) Plot both cooling curves on the same frame of axes and obtain from them the ratio of the time taken to cool over the same temperature interval when the temperature interval involved is:

(i) 60° C – 50° C (ii) 60° C – 45° C (iii) 55° C – 45° C.

(d) Calculate the total ratio of the total thermal capacities in the two experiments. (Take specific heat capacity of calorimeter as: Ccu = 400Jkg^{-1}K^{-1}. Cal = 890Jkg^{-1}K^{-1}. Specific heat capacity of water, Cw = 4200 Jkg^{-1} K^{-1}.

3. You are required to determine the resistance of the wire W per unit length and the length of the wire wound on a non-conducting material. Proceed as follows;

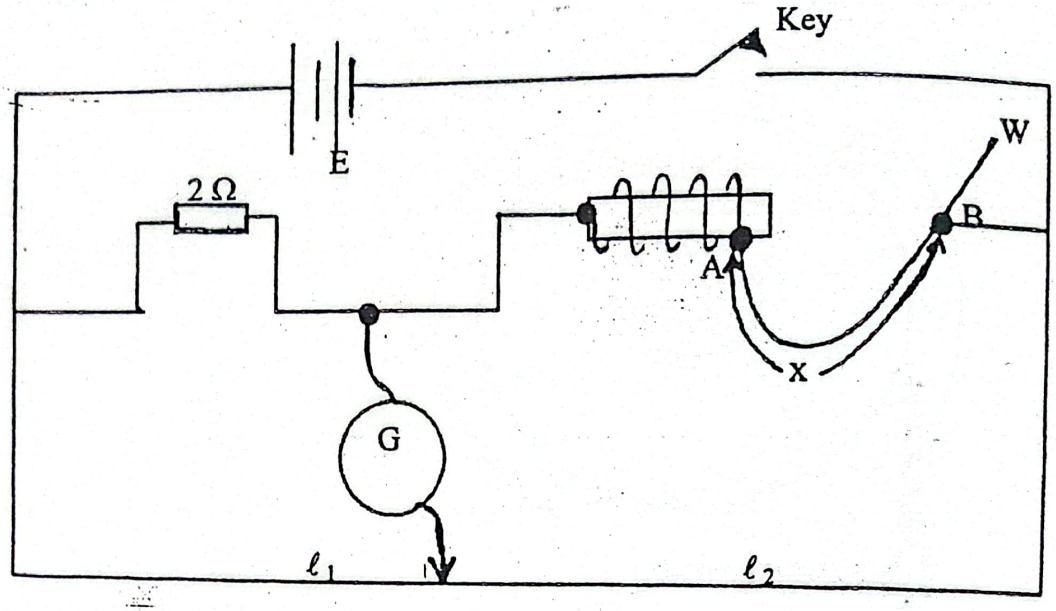

Fig.3

(a) Connect the circuit as shown in figure 3 above. E is a 3 V battery and G is a centre-zero galvanometer. Place a 2 Ω resistor on the left hand gap of the metre bridge and connect the wire provided to the right hand gap of the metre bridge.

(b) Determine the value of the resistance R of the wire W when AB = x = 70 cm. Terminal B can be adjusted to allow different values of x of the wire W.

(c) Repeat the experiment in (b) above for values of R when x = 50 cm, 40 cm, 30 cm, 20 cm and 10 cm. Tabulate your results for values of ℓ_1, ℓ_2, x and R.

(d) Plot a graph of R against x.

(e) Calculate the slope S of the graph.

(f) Use the relation $R = S(x + \ell)$ to determine the value of ℓ, where ℓ is the length of the wire wound permanently on a (wooden block) non-conducting material.

(g) Determine the value of x -intercept. What does it represent?