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 **5 May 2000 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. Write your examination number on every page of your answer booklet provided.
5. Mathematical tables and desk calculators may be used.
6. Acceleration due to gravity $g = 9.8 m/s^2$

This paper consists of 4 printed pages.

1. The aim of this experiment is to determine the radius of gyration of a solid steel spherical ball about an axis through its centre. Proceed as follows:

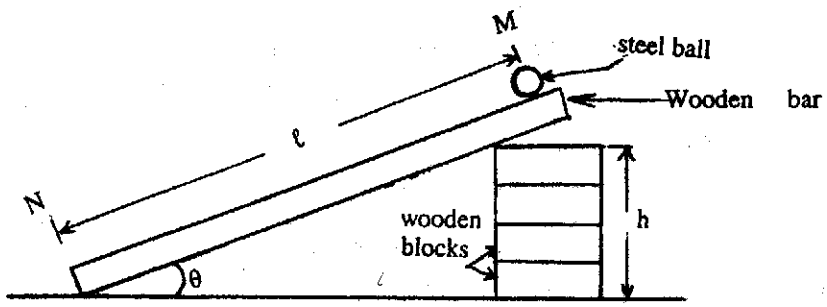


Fig.1

(a) Place ten (10) wooden blocks of dimensions 5cm x 3cm x 0.8cm one on top of the other so that the total height h is 8cm. Place a wooden bar of length 120cm so that it makes an inclination as shown in Fig.1. The wooden bar should have a track made at its centre to enable the ball to roll. With L = 110cm, start the ball from rest at M and measure the time t taken to reach the bottom at N. Repeat this three times.

(b) Repeat the procedure in (a) above by removing six (6) blocks one at a time, in order to obtain a total of six readings. Tabulate your results as follows.

Height h (cm)	t_1 (s)	t_2 (s)	t_3 (s)	Average Time t (s)	t^2 (s^2)	Sin θ = h/L	Acceleration A $=2\ell/t^2(cm/s^2)$

(c) Using a micrometer screw gauge, measure the mean diameter d of the ball and hence calculate its mean radius r in centimetres

(d) Plot a graph of acceleration A against Sin θ (horizontal axis)

(e) Calculate the slope S of your graph.

(f) Calculate the radius of gyration k of the ball given that

$$I = Mr^2 \frac{(g - S)}{S}$$

(g) State any two sources of errors in this experiment.

2. The aim of this experiment is to investigate the relation between the rate of loss of heat from a calorimeter and the temperature excess over its surroundings under conditions of forced convection. Proceed as follows:

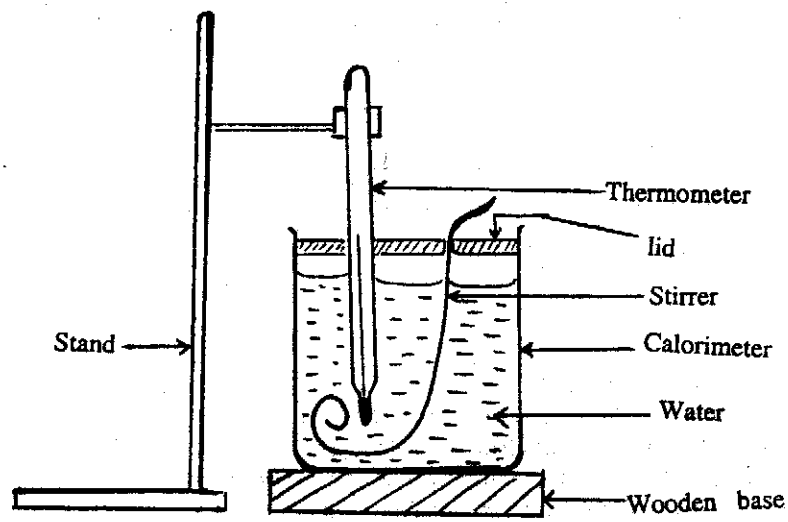


Fig. 2

(a) Set up an experimental arrangement as shown in fig.2 above.
(b) Pour in some hot water about 85°C into the calorimeter until it is about three-quarters full.
(c) Read and record the temperature θ of water after every two minutes beginning when the temperature of the water is about 80°C. As you progress, gently stir the water and fan the calorimeter. Take your readings for 20 minutes.
(d) Record the room temperature at the beginning and at the end of the experiment. Hence find the mean room temperature θ_o.
(d) (i) Plot a graph of $\log_{10}(\theta - \theta_o)$ against time t.

(ii) Theoretically the experiment obeys the relation $\text{Log}_{10}(\theta - \theta_o) = -kt + \text{constant}$. Determine the value of k and the constant.

(iii) What is the physical meaning of k.

(e) Mention two sources of errors in the experiment.

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

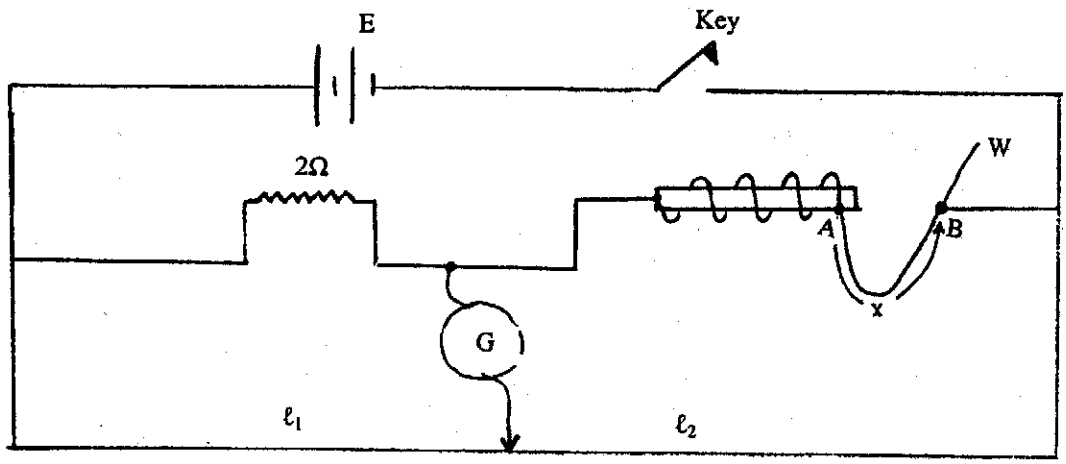


Fig.3.

(a) Connect the circuit as shown in Fig.3 above. E is a 3V battery and G is a centre – zero galvanometer. Place a 2Ω 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 = 50cm. Terminal B can be adjusted to allow for different values of x of the wire w.

(c) Repeat the experiment in (b) above for values of R when x = 40cm, 30cm, 20cm and 10cm respectively. Tabulate your result as follows:

x cm	ℓ_1(cm)	ℓ_2(cm)	R(Ω)

(d) Plot a graph of R (y-axis) against x (x-axis)

(e) Calculate the slope, S of the graph.

(f) Use the relation $\frac{R}{S} = x + l$ to determine the value of l, where l is the length of wire wound permanently on a non – conducting material.

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