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

131/3A

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

Time: 3:20 Hours **Monday, 09th May 2016 a.m.**

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), 15 marks each.
4. Calculations should be clearly shown.
5. Mathematical tables and non-programmable calculators may be used.
6. Cellular phones are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. Use the following:

   $\pi = 3.14$.

   Specific heat capacity of solid, $C_s = 370\ JKg^{-1}K^{-1}$

   Specific heat capacity of calorimeter, $C_c = 380\ JKg^{-1}K^{-1}$

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1. In this experiment you are required to investigate the oscillations of a pendulum. The pendulum is illustrated in Figure 1. As the pendulum oscillates, a stopper shortens the effective length, L by an amount, d.

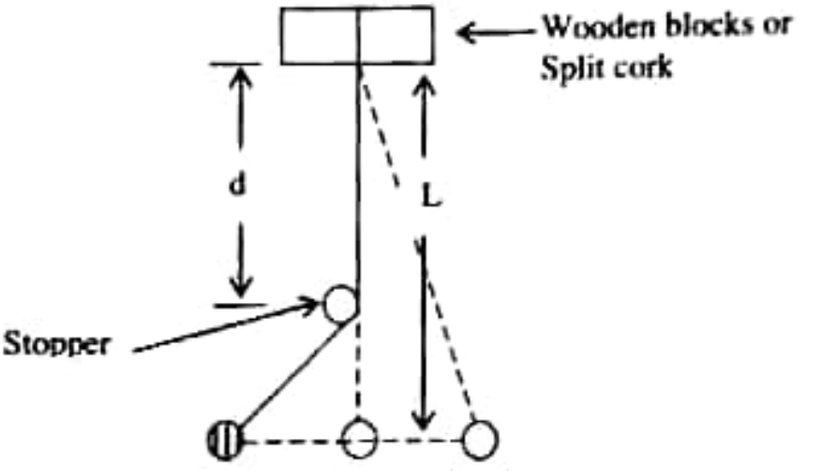


Figure 1

Proceed as follows:

(a) Set up a Pendulum of length of approximately 80cm using the equipment provided.

(b) Mount the Wooden rod horizontally so that it acts as a stopper at a distance d equals to 20cm. The stopper should just touch the string when the Pendulum rests in a vertical position.

(c) Gently displace the pendulum so that it performs small oscillations in a vertical plane perpendicular to the stopper.

(d) Make and record measurements to determine the periodic, T for 20 oscillations.

(e) Repeat the procedures (b) to (d) for four values of d in the range d = 30cm to d = 60cm at intervals of 10cm.

(f) Tabulate your results including the values of $\frac{d}{T}$.

(g) Plot the graph of T against $\frac{d}{T}$.

(h) Determine the gradient of the graph.

(i) Using the relation $T = -\frac{\pi^2}{g}\left(\frac{d}{T}\right) + 2\pi\sqrt{\frac{L}{g}}$, calculate the acceleration due to gravity, g.

(j) State two possible sources of error in this experiment.

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2. The aim of the experiment is to determine the specific heat capacity of a liquid, L by the method of mixtures.

Proceeds as follows:

(a) Set up the apparatus as shown in Figure 2.

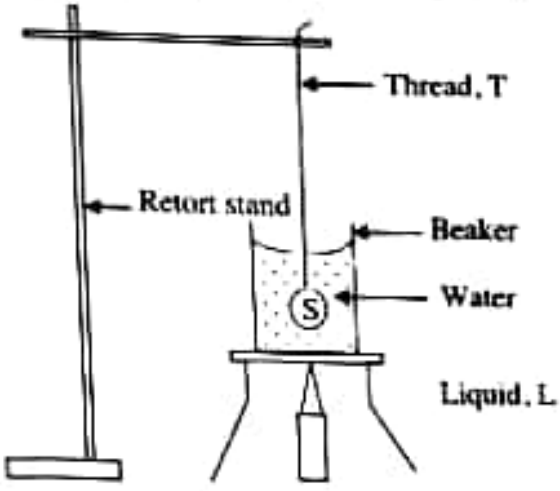


Figure 2 (a)

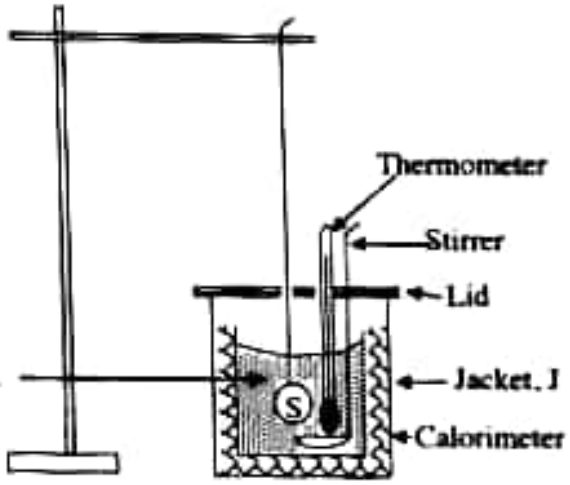


Figure 2 (b)

(b) Heat up the solid, S in a beaker contains some water to about 100^0C. Use a peace of thread, T to suspend the solid from the retort stand Figure 2 (a).

(c) Meanwhile

(i) Determine the mass M of the calorimeter when empty and when $\frac{2}{3}$ filled with cold liquid, L then calculate the mass of cold liquid, L.

(ii) Place the calorimeter $\frac{2}{3}$ filled with cold liquid, L in the jacket, J. Measure the initial temperature of the cold liquid.

(iii) Quickly transfer the solid into the calorimeter and cover it with a lid to minimize heat losses as indicated in Figure 2 (b). Stir well and record the equilibrium temperature, θ_1.

(iv) Remove the solid from the calorimeter and measure its mass, M_s.

(d) Apply the method of mixtures, show that the specific heat capacity, C_L of the liquid is given by:

$$M_L = \frac{M_s C_s(\theta_2 - \theta_1) - M_s C_s(\theta_1 - \theta_0)}{C_L(\theta_1 - \theta_0)}, \text{ where}$$

M_s = mass of calorimeter

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M_L = mass of liquid

θ_2 = temperature of boiling water $\approx 100^0C$

Calculate the value of C_L

(e) State two possible sources of error in this experiment.

(f) How to minimize the errors in 2 (e)?

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.

Proceeds as follows:

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

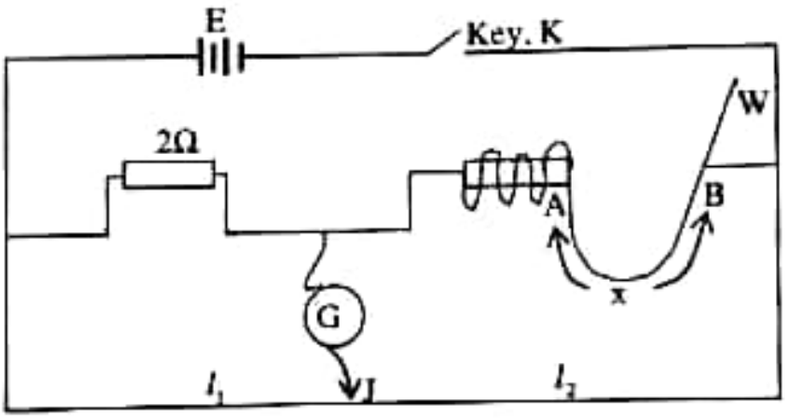


Figure 3

(b) Determine the value of the resistance R of the wire W when AB = x = 50cm. Terminal B can be adjusted to allow different values of x of the wire, W.

(c) Repeat the procedure in 3 (b) for values of R when x = 40cm, 30cm, 20cm and 10cm. Tabulate the results as follows:

x(cm)	l_1 (cm)	l_2 (cm)	R(Ω)

(d) Plot a graph of R against x.

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(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 the wire wound permanently on a non-conducting material.

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

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