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, $C_c = 380\ JKg^{-1}K^{-1}$

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.

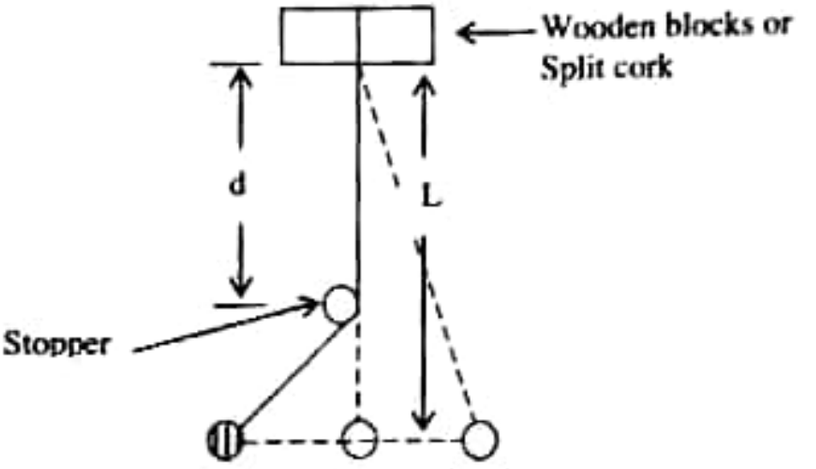

Figure 1

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.

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.

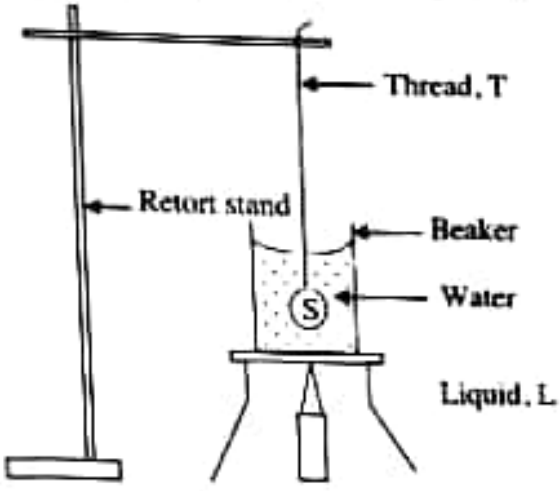

Figure 2 (a)

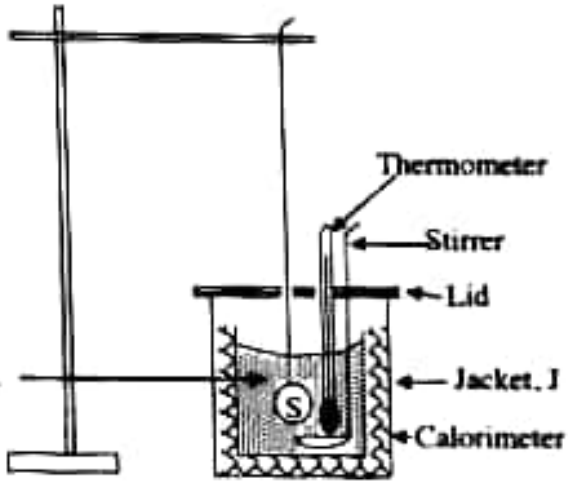

Figure 2 (b)

(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

M_L = mass of liquid

θ_2 = temperature of boiling water ≈ 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.

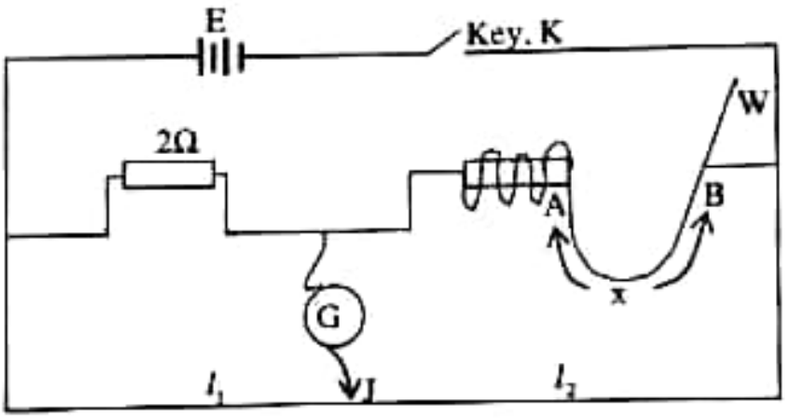

Figure 3

(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.

(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?