

**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, 09<sup>th</sup> 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,  $C_s = 370 \text{ J Kg}^{-1} \text{ K}^{-1}$   
Specific heat capacity of calorimeter,  $C_c = 380 \text{ J Kg}^{-1} \text{ K}^{-1}$

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,  $d$ .

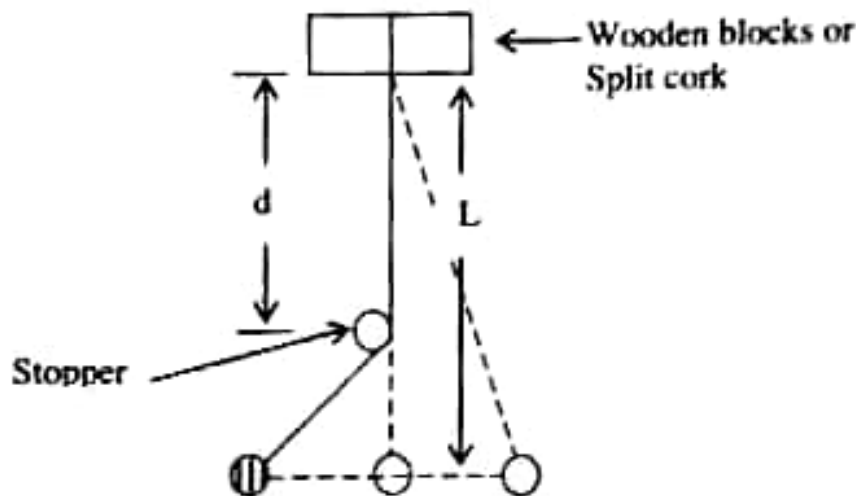


Figure 1

Proceed as follows:

- Set up a Pendulum of length of approximately 80cm using the equipment provided.
- 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.
- Gently displace the pendulum so that it performs small oscillations in a vertical plane perpendicular to the stopper.
- Make and record measurements to determine the periodic,  $T$  for 20 oscillations.
- Repeat the procedures (b) to (d) for four values of  $d$  in the range  $d = 30\text{cm}$  to  $d = 60\text{cm}$  at intervals of 10cm.
- Tabulate your results including the values of  $\frac{d}{T}$ .
- Plot the graph of  $T$  against  $\frac{d}{T}$ .
- Determine the gradient of the graph.
- 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,  $g$ .
- 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:

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

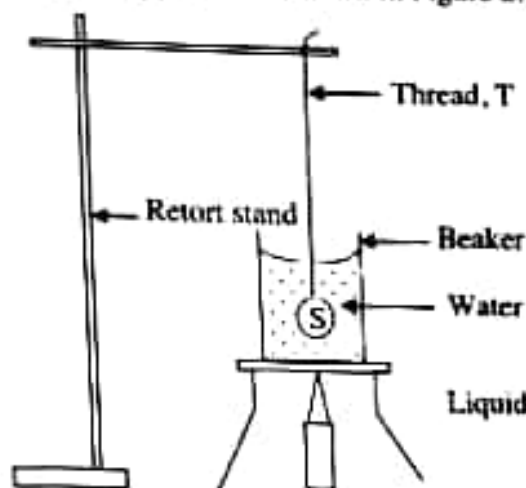


Figure 2 (a)

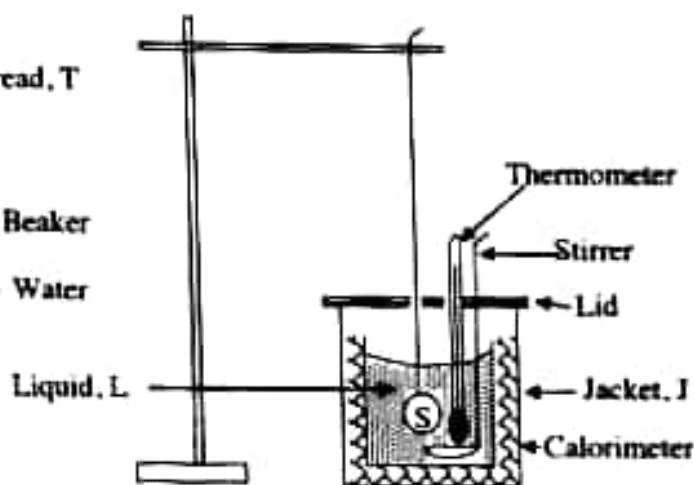


Figure 2 (b)

- (b) Heat up the solid, S in a beaker contains some water to about  $100^{\circ}\text{C}$ . Use a piece of thread, T to suspend the solid from the retort stand Figure 2 (a).
- (c) Meanwhile
- 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.
  - Place the calorimeter  $\frac{2}{3}$  filled with cold liquid, L in the jacket, J. Measure the initial temperature of the cold liquid.
  - 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,  $\theta_1$ .
  - 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:

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

$M_c$  = mass of calorimeter

$M_L$  = mass of liquid

$\theta_2$  = temperature of boiling water  $\approx 100^\circ\text{C}$

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  $2\Omega$  resistor on the left hand gap of the metre bridge and connect the wire provided on the right hand gap of the metre bridge.

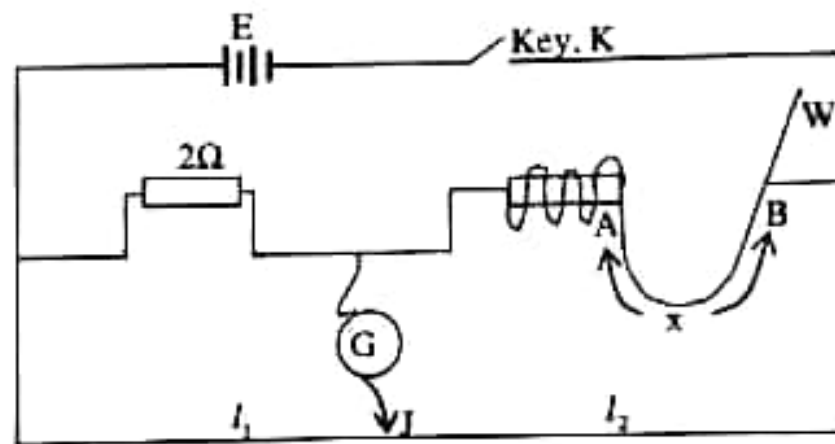


Figure 3

- (b) Determine the value of the resistance  $R$  of the wire  $W$  when  $AB = x = 50\text{cm}$ . 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  $x = 40\text{cm}$ ,  $30\text{cm}$ ,  $20\text{cm}$  and  $10\text{cm}$ . Tabulate the results as follows:

$x(\text{cm})$	$l_1(\text{cm})$	$l_2(\text{cm})$	$R(\Omega)$

- (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?