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

131/3C

PHYSICS 3C
ALTERNATIVE C PRATICAL
(For Both School and Private Candidates)

Time: 3:10 Hours *Wednesday, 24th February 2010 a.m.*

INSTRUCTIONS

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **Number 1** carries 20 marks and 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:

   $\pi = 3.142$.

This paper consists of 5 printed pages.

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1. The aim of this experiment is to determine the radius of gyration k of the rectangular sheet of card board provided and the acceleration due to gravity, g.

Proceed as follows:

(a) Using the weighted string locate the centre of gravity G of the cardboard provided. With the aid of sketch diagrams, briefly explain how you obtain the centre of gravity G.

Draw a line from the centre of gravity, G to any one of the four corners of cardboard.

Measure a distance of 2 cm from G along this line and make a hole at this point.

Make other four holes along the line such that all the holes are at a distance of 2 cm from each other.

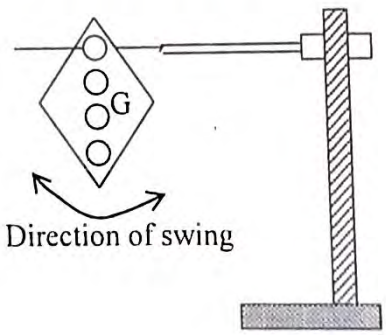

Figure 1

Set up the apparatus as shown in figure 1. Suspend the cardboard from the hole nearest to the centre of gravity G. Record the distance h which is the distance of the hole from G.

(b) Using the stop watch provided, obtain the time for 10 small oscillations of the cardboard.

Repeat this with other four values of h.

(c) Plot the graph of T^2h against h^2, where T is the period of oscillations.

(d) Given that $\frac{T}{2\pi} = \sqrt{\frac{k^2 + h^2}{gh}}$, determine the:

(i) Radius of gyration k.

(ii) Acceleration, g, due to gravity.

(e) State two (2) sources of error.

(20 marks)

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2 You are required to investigate the specific heat capacity of a liquid L by the method of cooling.

Proceed as follows:

(i) Assemble the apparatus as shown in Figure 2 .

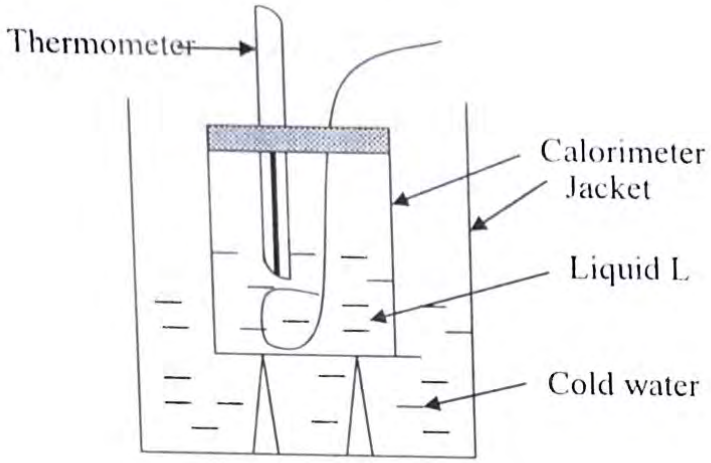

Figure 2

(ii) Weigh the calorimeter with lid and stirrer.

(iii) Fill the beaker with liquid L (¾ full) and heat liquid L on a burner until its temperature is 70 °C (liquid L is inflammable, don't heat it beyond 70 °C). Pour the hot liquid L into the calorimeter up to ¾ level and put the calorimeter in a cooling chamber (see the Figure 2).

(iv) Keep the liquid well stirred and when the temperature has fallen to 60 °C, record the temperature at a one minute (1 min) interval down to 40 °C.

(v) Remove the thermometer and reweigh the calorimeter with its content. Empty and clean the inside part of the calorimeter.

(vi) Fill the calorimeter with liquid W (same level as for liquid L) that has been heated to about 70 °C.

$\theta = \theta_0 + 28e^{-0.33t}$

vii) Repeat procedures in (iii) – (v) above. Remove the thermometer and re-weigh the calorimeter and its contents.

(a) Record the pairs of values as shown in Table 2.

Table 2

Time (min)	Temperature (°C)	
	Liquid L	Liquid W

$k = \frac{1}{t} \ln \left(\frac{60 - 30}{58 - 30} \right)$

$k = 0.06$

$\theta = (\theta_0 + \theta_s) e^{-kt}$

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(b) On the same axes, plot the graph of θ °C against time t (min) for both liquids.

(i) Find the time of cooling from 55 °C to 45 °C for both liquids.

(ii) Use the equation

$$(M_I C_I + M_L C_L)\frac{(\theta_1 - \theta_2)}{t_L} = (M_I C_I + M_W C_W)\frac{(\theta_1 - \theta_2)}{t_W}$$

where M_I = Mass of calorimeter + lid + stirrer

M_L = mass of liquid L

C_L = specific heat capacity of liquid L

M_W = mass of water

C_W = specific heat capacity of water = $4.2 \times 10^3 Jkg^{-1}k^{-1}$

C_I = $3.8 \times 10^2 Jkg^{-1}k^{-1}$

Calculate the value of the specific heat capacity of liquid L (C_L).

(15 marks)

3. The aim of this experiment is to determine the resistivity of the bare wire provided using a metre-bridge.

You are provided with:

2 – ohm resistor, R

Metre bridge, M, and its accessories

150 cm length of bare wire, W

2 V accumulator/2 dry cells, A

Crocodile clip, C

Procedure

Set up a metre-bridge circuit in which a 2 – ohm resistor is connected in the left hand gap. To one of the terminals of the right hand gap connect both ends of the bare wire supplied so that 150 cm make up a loop, L. (see Figure 3)

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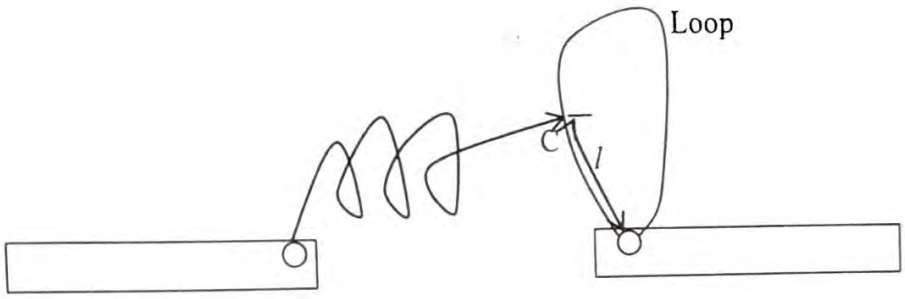

Figure 3

(a) Using a crocodile clip C connect a known length (about 20 cm) of the loop across the gap.

Find the balance point and calculate the equivalent resistance, R_e in the right hand gap. Increase ℓ in steps of 20 cm and for each value of ℓ, Calculate the equivalent resistance at balance point.

Record your observations in a suitable table including a column of Re/ℓ.

(b) (i) Plot a graph of Re/ℓ (y – axis) against ℓ (x – axis) starting at the origin.

(ii) From the graph in b(i) above determine the average value Q, the resistance per metre of the wire.

(iii) Measure the diameter of the wire and hence calculate the resistivity of the wire.

(15 marks)

ℓ	Re	Re/L	L
20			

L = 30

100 − L = 70

Re = ρ/A (Q − Q₁)

= 1/1 (

69 59

58

60 —

ℓ =

100 − L

20 — 30

20 — 30 43

— 46

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