THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN SECONDARY EDUCATION EXAMINATION

731/2A

PHYSICS 2A
(ACTUAL PRACTICAL A)

Time: 3 Hours **Thursday, 08th May 2014 a.m.**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question one carries 40 marks and the rest carry 30 marks each.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).

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1. The aim of this experiment is to determine the density of softwood (pine tree wood).

Apparatus

1 pc of Pendulum bob labeled *X*, 4 pieces of dry softwood (pine tree wood) blocks labeled *A*, *B*, *C* and *D* of dimensions as shown in the table below;

Block of wood	Width	Breadth	Length
A	2cm	2cm	3cm
B	2cm	2cm	4cm
C	2cm	2cm	5cm
D	2cm	2cm	6cm

100cm Cotton thread, $100cm^3$ Measuring Cylinder, Triple Beam Balance and Clean water.

Procedures

(i) Use the triple beam balance provided to measure the mass of wooden blocks *A*, *B*, *C* and *D* in grams.

(ii) Pour some water into the measuring cylinder up to half of its volume, read and record the volume V_1 of water.

(iii) Tie a cotton thread to a pendulum bob and slowly immerse it completely into water, read and record the volume V_2 of water.

(iv) Remove the pendulum bob from the water; tie the cotton thread to the soft wood block A together with the pendulum bob closer to each other.

(v) Slowly, lower the bob and the wooden block into water; make sure they are both completely immersed in water then read and record the new volume V_3.

(vi) Repeat the procedures (i) to (v) above for blocks of wood *B*, *C* and *D*, and record your findings in the table below.

Block of wood	Mass (*M*) (gm)	Volume V_2 (cm^3)	Volume V_3 (cm^3)	Volume (V_3- V_2) (cm^3)
A				
B				
C				
D				

Questions

(a) Plot the graph of volume (V_3-V_2) against mass *M*.

(b) Find the slope from your graph.

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(c) Use the slope obtained in (b) to find the density of wood provided.

(d) State two sources of errors in this experiment and suggest ways of eliminating them.

2. The aim of this experiment is to determine the emissive power K of aluminium at 65° C.

Apparatus

3 pieces of rubber bands, 10cm x 25cm pieces of aluminium foil, 150cm^3 to 200cm^3 copper calorimeter with circular wooden cover having holes for stirrer and thermometer, vernier caliper to be shared, triple beam balance, stop watch and container of hot water about $80^{\circ}C$ to be shared.

Procedures

(i) Use the rubber bands provided to tightly cover the external areas (sides and bottom) of the calorimeter with the pieces of aluminium foil available.

(ii) Weigh the calorimeter together with its aluminium cover and record its mass m in kg (Assume that m represents the mass of the copper calorimeter).

(iii) Measure the average external diameter d of the calorimeter and its height h using Vernier Calipers. Thus determine its external area A using the equation $A = \pi dh + \frac{\pi d^2}{4}$.

(iv) Note and record the room temperature θ_o.

(v) Open the jaws of the Clamp on the retort stand and adjust it so that the calorimeter can rest on it steadily.

(vi) Pour hot water from the container labeled hot water into the calorimeter so that it is just about $\frac{2}{3}$ filling the calorimeter. Put the wooden cover on the calorimeter tightly, put the calorimeter and close the hole in the wooden cover using cotton wool and rest the calorimeter on the clamp.

(vii) Starting with the temperature θ of the water at about $75^{\circ}C$ and taking the readings every 2 minutes, record the temperature θ corresponding to time t of cooling until the temperature drops to $55^{\circ}C$ and while doing this, fan the calorimeter with some sheet of paper so that the current of air cools the calorimeter continually; record the value of θ and t.

(viii) Remove the cover from the calorimeter and reweigh the calorimeter with the water, note and record its mass M in kg.

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Questions

(a) Plot a graph of θ against $V_s t$ and use the graph to determine the slope $\Delta\theta/\Delta t$ at the temperature $65^{o}C$.

(b) Calculate the rate of heat loss to the surroundings $\Delta H/\Delta t$ given that $\frac{\Delta H}{\Delta t} = [(M-m)(C_w + mC)]\frac{\Delta\theta}{\Delta t}$.

Where $C_w = 4.2x10^3 JKg^{-1}K^{-1}$ and
$C = 4.0x10^2 JKg^{-1}K^{-1}$

(c) Use the Newton's law of cooling $\left(\frac{\Delta H}{\Delta t} = KA(\theta - \theta_o)\right)$ to determine the value of *K*.

3. The aim of this experiment is to determine the electromotive force *(E)* and the internal resistance *(r)* of a cell.

Apparatus

An Ammeter *A*, a tapping key *K*, resistance box *R*, a dry cell *E* and connecting wires.

Procedures

(i) Tune *R* of *1Ω* connected in series with circuit components of current *I*, read and record the value of *I*.

(ii) Repeat the process in (i) above for values of *R* equal to; *2Ω*, *3Ω*, *4Ω* and *5Ω*.

(iii) Tabulate the results obtained in (ii) above including the column for quantity $\frac{1}{I}$ in the same table.

Questions

(a) Plot the graph of *R Ω* against $\frac{1}{I}A^{-1}$.

(b) Find the electromotive force *(E)* and the internal resistance *r* of a cell.

(c) State any source of errors and precautions to minimize errors.

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