P510/3
PRACTICAL
PHYSICS
Paper 3
August. 2019
3 ¼ hours

UNNASE MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

PRACTICAL PHYSICS

Paper 3

3 HOURS 15 MINUTES

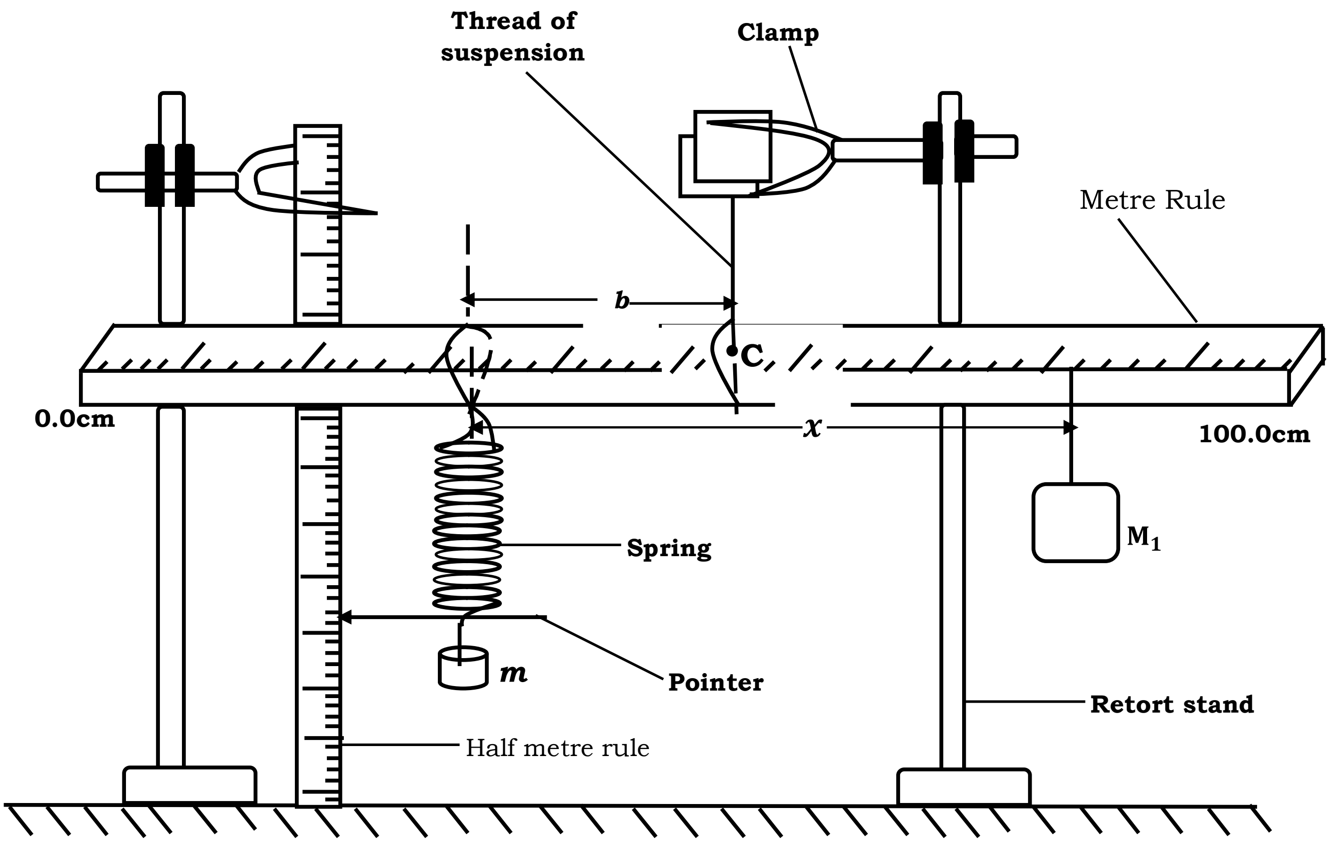
INSTRUCTIONS TO CANDIDATES:

- *Answer question 1 and one other question.*
- *For each question, candidates will be required to select suitable apparatus from the equipment provided.*
- *Any additional question answered will not be marked.*
- *Candidates are not allowed to use the apparatus for the **first fifteen minutes**.*
- *Mathematical tables and non – programmable scientific electronic calculators may be used.*
- *Candidates are expected to record on their scripts all their observations as these observations are made and to plan to the presentation of the records so that it is not necessary to make a fair copy of them. The working of the answers is to be handed in.*
- *Details on the question paper should not be repeated in the answer, nor is the theory of the experiment required unless specifically asked for. However, candidates should record any special precautions they have taken and any particular feature of the method of going about the experiment.*
- *Marks are given mainly for a clear record of observations actually made, for their suitability, and for the use made of them.*

1. In this experiment, you will determine constant, K, of the spring provided by two methods. *(40 marks)*

METHOD I

a) Suspend the metre rule from the retort stand clamp with its scale facing upwards using a piece of thread.
b) Suspend the spring at the 40.0cm mark of the metre rule.
*c) Adjust the position of the loop of the thread until the metre rule balances horizontally as shown in **figure 1***



d) Locate the point C at which the metre rule balances horizontally from the 0.0cm mark.
e) Locate the point C at which the metre rule balances horizontally from the 0.0cm mark.
f) Find the distance, b, of the spring from point C.
g) Read and record the initial position, $\boldsymbol{p_o}$ *of the pointer from the half metre rule (in metres)*
h) Suspend a mass $m = 0.050kg$ *from the lower free end of the spring, and a mass* $M_1 = 0.200kg$ *at the 50.0cm mark of the metre rule.*
i) Adjust the position of M_1 *until the metre rule balances horizontally again.*
j) Read and record the new position, $\boldsymbol{p}$*, of the pointer (in metres)*
k) Calculate the extension,$\boldsymbol{e}$*, of the spring.*
l) Measure and record the distance x

m) *Repeat procedures (g) to (k) for values of* $m = 0.100,\ 0.150,\ 0.200,\ 0.250\ amd\ 0.300kg$

n) *Record your results in a suitable table including values of* $y = x - b$ *and* $\frac{y}{b}$.

o) *Plot a graph of* $\frac{y}{b}$ *against e*

p) *Find the slope, S, of the graph.*

q) *Calculate the values of* K_1 *from the expression* $K_1 = \frac{Sg}{5}$

Where $\boldsymbol{g = 9.81ms^{-2}}$

METHOD II

a) Clamp the spring provided using the two pieces of wood provided and attach a pointer to the free end of the spring, making sure that the spring is vertical and the pointer is horizontal as shown in ***figure 2***.

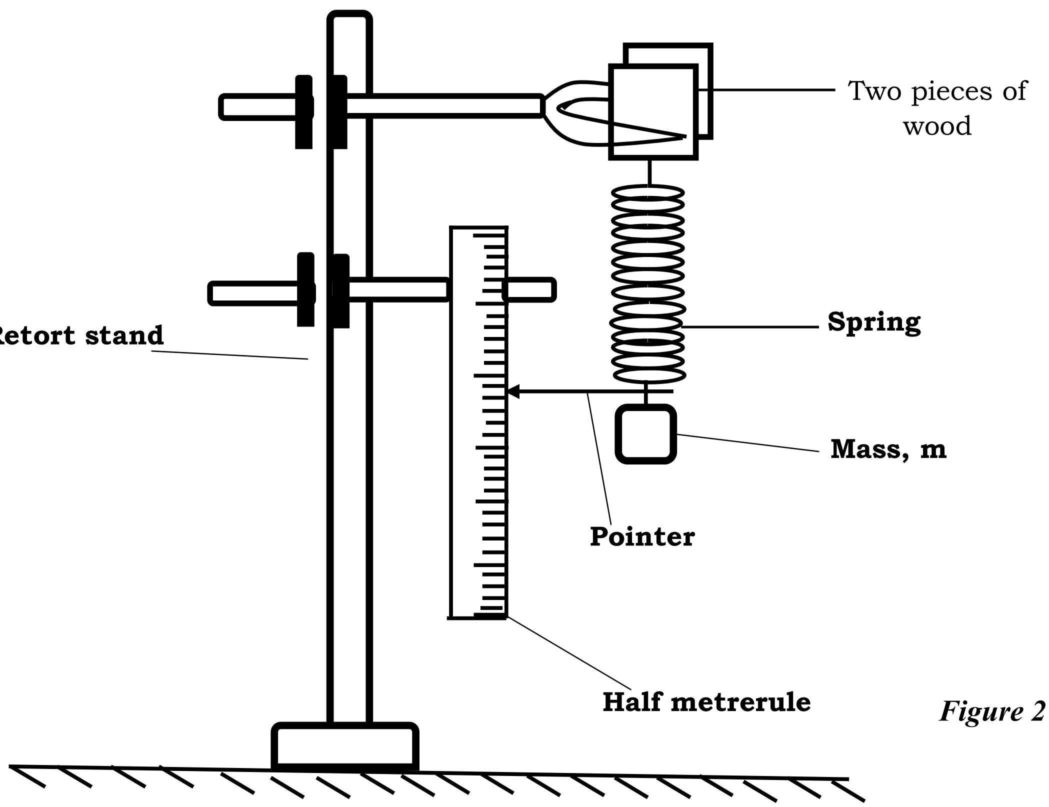


Figure 2

b) *Read and record the initial position,* y_o *of the pointer on the half metre rule.*

c) *Suspend a mass,* $m_1 = 0.200kg$ *from the lower free end of the spring.*

d) *Read and record the new position,* y_1 *of the pointer.*

e) *Find the extension* $x_1 = y_1 - y_o$ *(in metres) produced in the spring.*

f) *Replace the mass* m_1 *with* $m_2 = 0.300kg$.

g) *Read and record the position of the pointer,* y_2 *on the half metre rule*

h) *Find the extension* $x_2 = y_2 - y_o$ *(in metres).*

i) *Find the value of from the expression* $K_2 = \frac{(m_2 - m_1)g}{x_2 - x_1}$.

Where $\boldsymbol{g = 9.81ms^{-2}}$

j) *Calculate the constant, K of the spring from the expression:*

$$2K = K_1 + K_2$$

2. In this experiment, you will determine the property, μ, of the material of the glass block provided by two methods. *(40 marks)*

METHOD I

a) *Fix a plain sheet of paper on a soft board using drawing pins.*
b) *Place the glass block centrally on the sheet of paper with its broadest face uppermost.*
c) *Trace the outline ABCD of the glass block as shown in figure 3.*

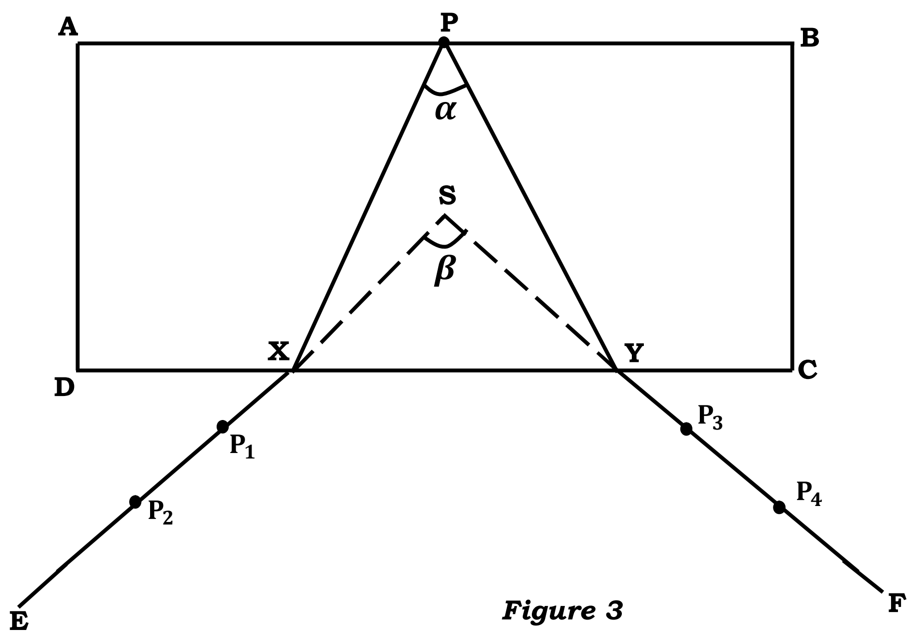


Figure 3

d) *Remove the glass block*
e) *Fix a pin, P, vertically along AB at a point mid – way between A and B.*
f) *Replace the glass block.*
g) *While looking through the glass block from side D of the glass block, fix pins* P_1 *and* P_2 *such that they appear to be in line with the image of P.*
h) *Repeat procedure (g) while looking through the glass block from side C and fix pins* P_3 *and* P_4 *such that they appear to be in line with the image of P.*
i) *Remove the glass block and the pins.*
j) *Draw lines through* P_1, P_2 *and* P_3, P_4 *to meet CD at X and Y respectively.*
k) *Join X and Y to P and produce EX and FY to meet at S.*
l) *Measure and record the angles* α *and* β.
m) *Determine the value of* μ_1 *from the expression:* $\mu_1 \tan\frac{\alpha}{2} = \tan\frac{\beta}{2}$

METHOD II

a) *Measure and record the breadth, t, of the glass block.*
b) *Fix a white sheet of plain paper on the soft board using drawing pins.*
c) *Place the glass block in the middle of the plain paper and trace its outline ABCD.*
d) *Remove the glass block.*
e) *Draw a perpendicular to AB at N, about 2.0cm from end A as shown in* ***figure 4***.

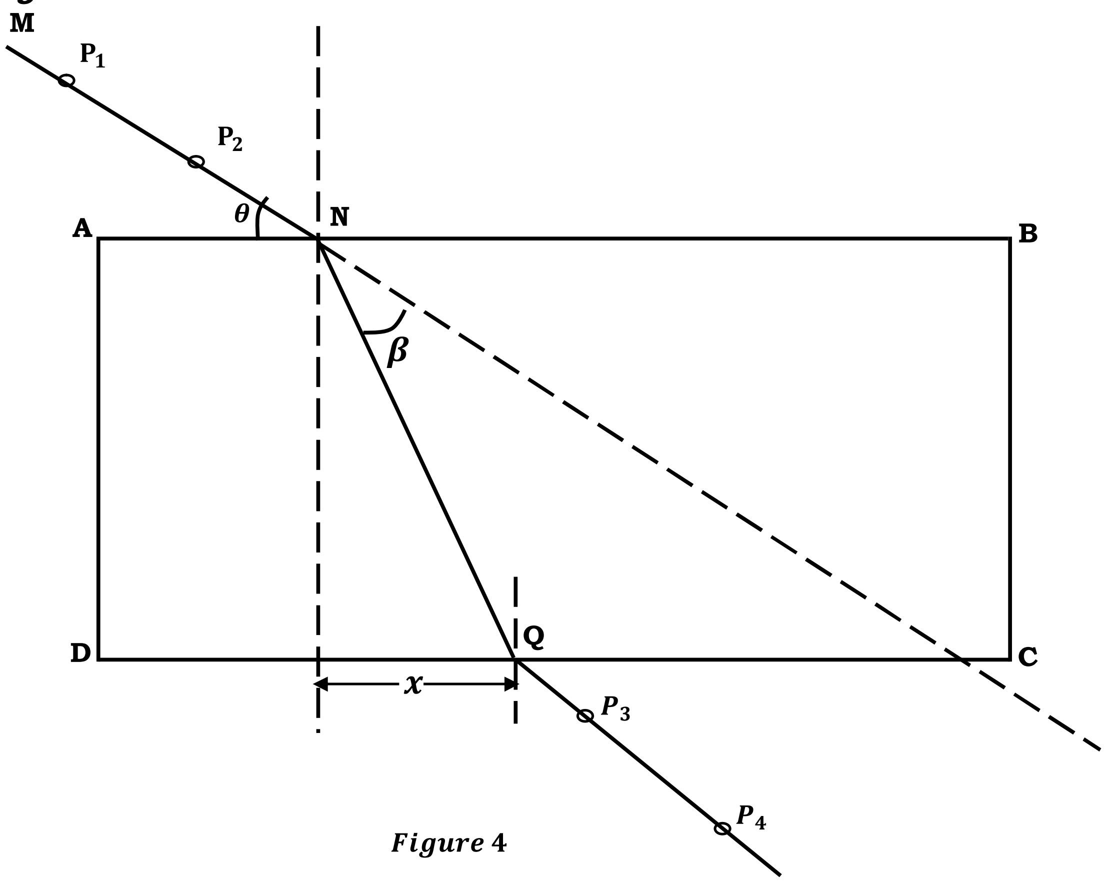


Figure 4

f) *Draw a line MN so that angle* $\theta = 20^o$
g) *Replace the glass block on the plain paper and stick pins P_1 and P_2 along line MN.*
h) *While looking through the glass block from side DC, fix pins P_3 and P_4 such that they appear to be in line with the images of P_1 and P_2*
i) *Remove the glass block and the pins.*
j) *Draw a line through P_3 and P_4 to meet DC at Q.*
k) *Join Q to N.*
l) *Measure and record the distance* $\boldsymbol{x}$ *and angle* $\boldsymbol{\beta}$**.**
m) *Repeat procedures (f) to (l) for values of* $\theta = 30^o,\ 40^o,\ 50^o,\ 60^o$ *and* 70^o
n) *Tabulate your results including values of* $\cos\theta$, $\alpha = (\theta + \beta)$ *and* $x \sin\alpha$
o) *Plot a graph of* $x\sin\alpha$ *against* $\cos\theta$.
p) *Determine the slope, S of the graph.*

q) *Calculate the value of* μ_2 *from the expression* $\mu_2 = \frac{t}{s}$

r) *Find the property, from the expression* $\mu = \frac{\mu_1+\mu_2}{2}$

HAND IN YOUR TRACING PAPERS TOGETHER WITH YOUR SCRIPT.

3. In this experiment, you will determine the internal resistance, r, of the dry cell labelled C provided. *(40 marks)*

PART I

a) *Measure and record the diameter, d, of the bare wire W provided.*

b) *Fix the wire W on the metre rule using cellotape and connect the circuit as shown in figure 5.*

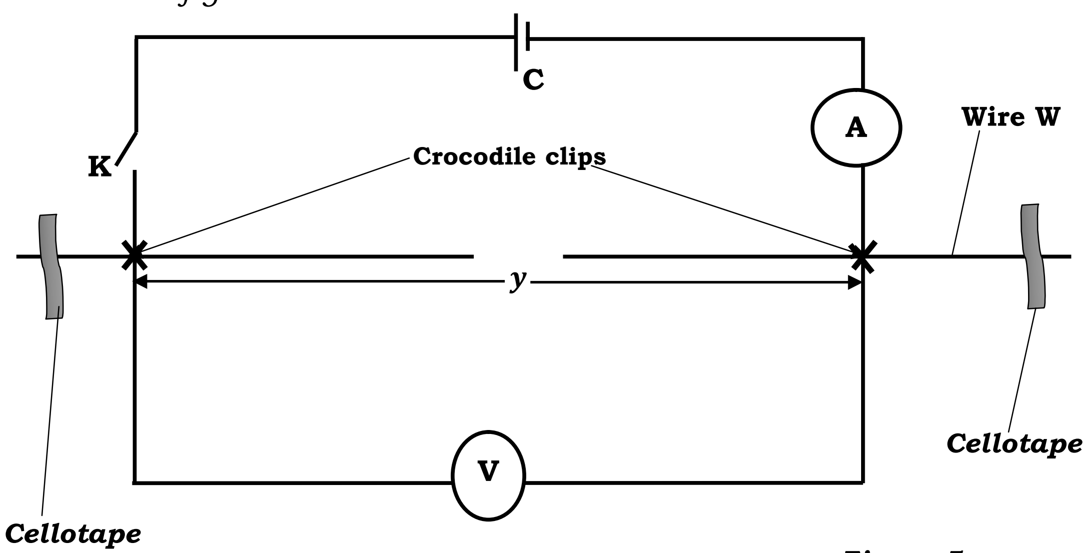


Figure 5

c) *Adjust the length, y, of the wire between the crocodile clips to* $y = y_1 = 0.200m$.

d) *Close switch K.*

e) *Read and record the ammeter reading,* I_1 *and the voltmeter reading,* V_1.

f) *Open switch K.*

g) *Repeat procedures (c) and (d) for* $y = y_2 = 0.600m$.

h) *Read and record the ammeter reading* I_2 *and voltmeter reading* V_2.

i) *Open switch K.*

j) *Find the resistivity, of the wire W from the expression:*

$$\rho = \frac{\pi d^2}{8}\left(\frac{V_1}{I_1 y_1} + \frac{V_2}{I_2 y_2}\right)$$

PART II

a) *Connect the circuit as shown in* ***figure 6***

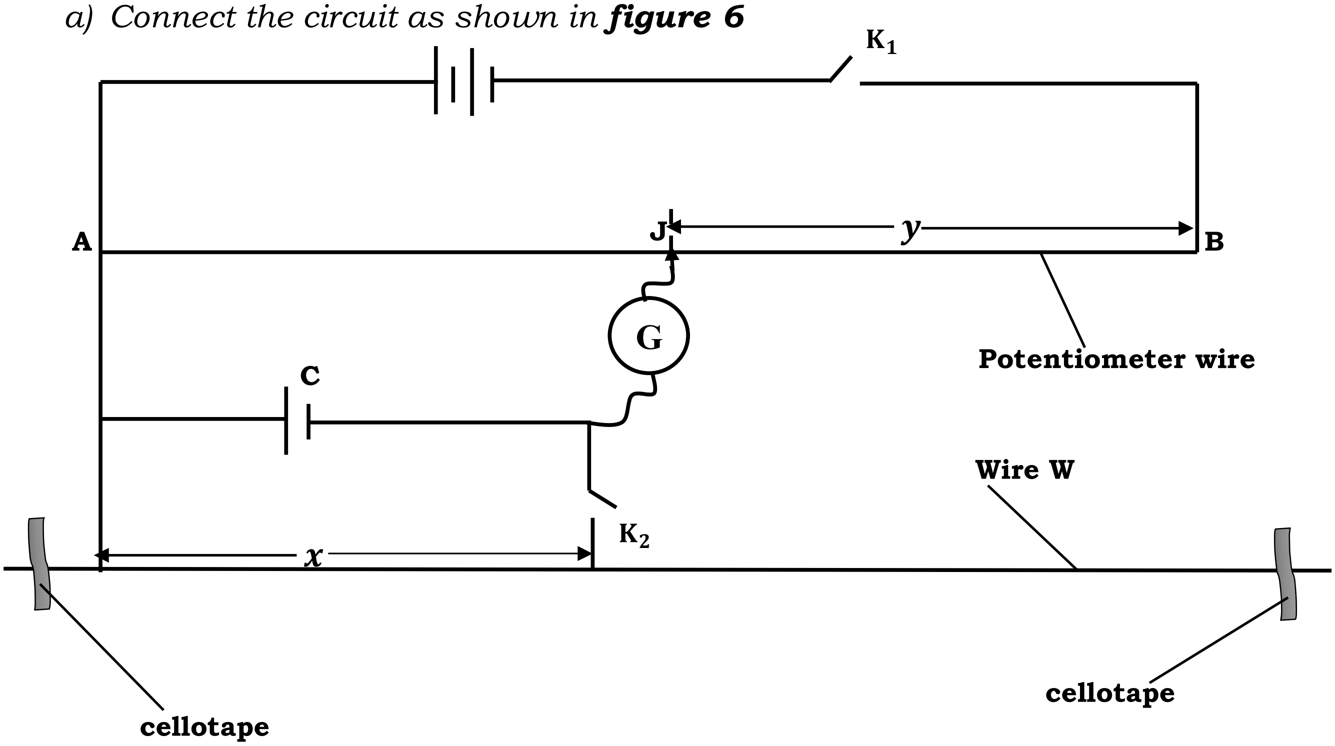


Figure 6

b) *With switches K_1 closed and K_2 open, move the sliding contact along the potentiometer wire until the galvanometer shows no deflection.*

c) *Read and record the balance length, l_0 (in metres) from end A of the potentiometer wire.*

d) *Adjust the length, x, of the wire W on the metre rule to* $x = 0.200m$.

e) *Close switches K_1 and K_2.*

f) *Move the sliding contact along the potentiometer wire and obtain the balance point J.*

g) *Measure and record the distance,* $\boldsymbol{y}$*, in metres from end B of the potentiometer wire.*

h) *Open switches K_1 and K_2.*

i) *Repeat procedures (d) to (h) for values of* $x = 0.300,\ 0.400,\ 0.500,\ 0.600$ *and* $0.700m$.

j) *Record your results in a suitable table including values of* $\frac{1}{x},\ l = 1 - y$ *and* $\frac{1}{l}$

k) *Plot a graph of* $\frac{1}{l}$ *against* $\frac{1}{x}$.

l) *Find the slope, S, of the graph.*

m) *Determine the internal resistance, r, of the dry cell labelled C from the expression:*

$$r = \frac{4S\rho l_0}{\pi d^2}$$

****** END ******