PHYSICS III
031

28/11/ 2018 8.30 AM – 10.00 AM

Rwanda Education Board

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2018

SUBJECT: PHYSICS

PAPER III: PRACTICAL PHYSICS

COMBINATIONS:

- PHYSICS-CHEMISTRY-BIOLOGY (PCB)
- PHYSICS-CHEMISTRY-MATHEMATICS (PCM)
- MATHEMATICS-PHYSICS-GEOGRAPHY (MPG)
- MATHEMATICS-PHYSICS-COMPUTER SCIENCE (MPC)

DURATION: 1 Hour 30 minutes

INSTRUCTIONS:

1) Write your names and index number on the answer **booklet cover in the space provided** as written on your registration form and **DO NOT** write your names and index number on additional answer sheets of paper if provided.
2) Do not open this question paper until you are told to do so.
3) This paper consists of **one** compulsory question. **(40 marks)**
4) You may use a non-programmable calculator, geometric set and a ruler, 30 cm long.
5) All answers should be written in the answer booklet provided.
6) Remove the mass from the spring when you are recording the experimental data/ results.
7) Use only a **blue** or **black** pen and **pencil.**

ATTEMPT ALL QUESTIONS (40 Marks)

In this experiment, you are required to determine the angle of incidence and the angle of emergence at which minimum deviation occurs through an equilateral glass prism.

Apparatus required:

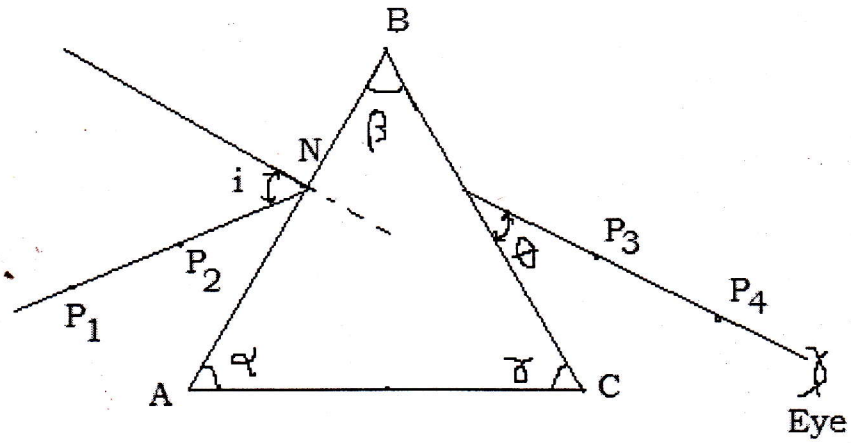
1 equilateral glass prism
1 soft board
4 optical pins
4 drawing pins
1 protractor
1 plane white sheet of paper A4
1 pencil with rubber
1 razor blade to sharpen pencils or 1 pencil sharpener
1 ruler 30 cm long or 15 cm long

Procedure:

a) Fix a plane white sheet of paper on a soft board using 4 drawing pins provided.

b) Place a glass prism on the white sheet of paper with the triangular face on the paper and tracing round its edges marking angles α, β, γ on your answer sheet.
Measure and record the angles α, β, γ. **(3 marks)**

c) Mark the corners A,B and C of the prism as shown in the diagram below after tracing its outline using a sharp pencil. Remove the prism.



d) Mark the point N, 2 cm from the vertex B of the prism. Draw the normal line through N.

e) Draw a line making an angle $i = 30.0°$ as shown not to scale in the diagram above.

f) Fix two pins p_1 and p_2 vertically upright on this line you have drawn in (e) above.

g) Replace the prism on the sheet of paper such that its surfaces and vertices coincide exactly with that you have drawn in (c).

h) From the face BC of the prism, view the images of pins p_1 and p_2.

i) While viewing, fix pins p_3 and p_4 such that they are in line with the images of pins p_1 and p_2.

j) Remove the pins and the prism.

k) Draw a line passing through the marks of pins P_3 and P_4 to meet the surface BC (see the given diagram).

l) Measure and record the angle θ with one decimal place.

m) Repeat the procedures (e) to (l) for the angles of incidence $i = 40.0°, 50.0°, 60.0°, 70.0°$ and $80.0°$.

n) Record your results in a suitable table including the angles i, θ, $\delta = 90 - \theta$. **(15marks)**

o) Plot a graph of δ (along the vertical axis) against incidence angle i (along the horizontal axis).Draw a best fit straight line . **(7marks)**

p) On the same axes, draw the line $\delta = i$ **(1mark)**

q) Read and record the values of δ_0 and i_0 at the point of intersection of the two graphs from the procedures (o) and (p) **(2marks)**

r) Calculate the minimum deviation angle D_m from $D_m = (\delta_0 + i_0) - \beta$ **(2marks)**

s) Interpret your result. **(4marks)**

t) Submit the unique sheet of paper used during the experiment which will be used in the marking of the diagram. **(6marks)**