CHRISTIAN SOCIAL SERVICES COMMISSION (CSSC)

NORTHERN ZONE JOINT EXAMINATIONS SYNDICATE (NZ-JES)

FORM SIX PRE-NATIONAL EXAMINATIONS 2026

PHYSICS 3A

131/3A

Time: 3:20 Hours **Wednesday, 4th March 2026 a.m**

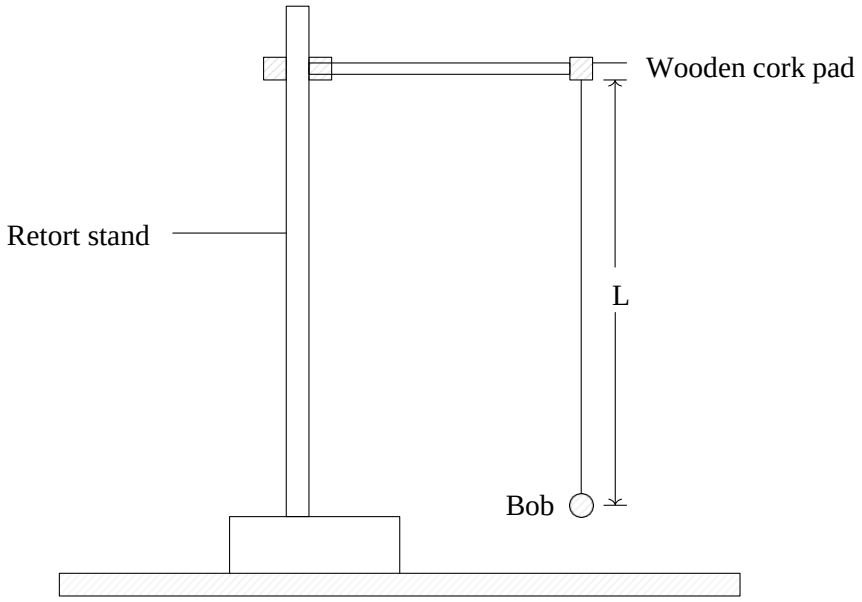
Instructions.

1. This paper consists of **three (3)** questions. Answer **all** questions.
2. **Question 1** carries **20 marks** while **question 2** and **question 3** carries **15 marks** each.
3. Calculations should be clearly shown.
4. Mathematical tables and **non programmable** calculator may be used.
5. Cellular phones are **not allowed** in the examination room.
6. All answers must be written in the answer booklet(s) provided.
7. Write your **examination number** in every page of your answer booklet(s).
8. The following information may be useful:
   (a) Pie, $\pi = 3.14$
   (b) Specific heat capacity of copper $= 400$ Jkg^{-1}K^{-1}.
   (c) Specific heat capacity of liquid **W**$= 4{,}200$ Jkg^{-1}K^{-1}.

1. The aim of the experiment is to determine the coefficient of rigidity (shear modulus) η of the wire provided.

Proceed as follows:

(a) Measure the length of the wire L=90cm and suspend the pendulum bob as shown in figure 1.



(b) Twist the bob in a small angular displacement so as to give the wire a shear strain and release it. Record the time for 20 vibrations hence determine the periodic time T(s)

(c) (i) Repeat procedure in (b) above for L= 80cm,70cm, 60cm, 50cm and 40cm.

(ii) Tabulate your results for L(m), t(s) and $T^2(s^2)$

(d) Measure mass M and radius r of the bob using the micrometer screw gauge provided.

(e) (i) Plot a graph of T^2 against L and

(ii) Find the slope. Given that $T^2 = \frac{8\pi IL}{\eta a^2}$

where $I=0.4mr^2$, a=radius of wire. Determine coefficient of rigid y

(f) State two sources of error.

2. Your provided with a calorimeter, stirrer, thermometer, source of heat, stop watch, measuring cylinder, $250cm^3$ beaker and water bath respectively.

Proceed as follows:

(a) Read and record room temperature θ_R

(b) Measure $100cm^3$ of hot water using measuring cylinder and transfer into calorimeter.

(c) While stirring record the time taken by the liquid to cool starting a stop watch when the temperature is $80^\circ C$.

(d) Record the temperature $\theta^\circ C$ after every 2 minutes interval until the time is 20 minutes.

Questions:

(i) Tabulate your results.

(ii) Plot the graph of $\log_{10}(\theta-\theta_R)$ against time t.

(iii) Write down the equation of your graph including the slope and vertical intercept.

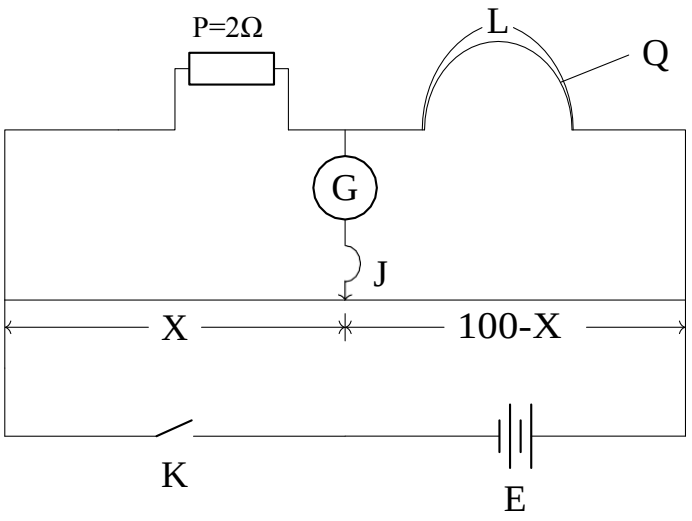
(iv) State the law governing this experiment.

(v) Suggest the aim of this experiment.

3. You are provided with a metre bridge, Jokey, two dry cells E, Key K, galvanometer G, 2Ω standard resistor P, wire labelled Q and connecting wires.

Proceed as follows:

(a) Setup the experiment as shown below:



(b) Starting with L=20cm obtain the balance point X on the metre bridge and determine the value 100-X respectively.

(c) Repeat procedure 3(b) for L=30cm, 40cm,50cm and 60cm respectively.

Questions:

(i) Tabulate your results including column of X, 100-X and $\frac{X}{100-X}$ respectively

(ii) Plot the graph of $\frac{X}{100-X}$ against $\frac{1}{L}$

(iii) Develop theory of this experiment.

(iv) Determine the resistivity of wire **Q** graphically.

(v) Write down the aim of this experiment.

(vi) Determine the diameter of the wire labeled **Q.**