THE PRESIDENT'S OFFICE

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

FORM SIX COMPETENCE EXAMINATIONS (FOSCE) -2025

CODE: 131/3 **PHYSICS 3A**

TIME: 3 HOURS **28TH FEBRUARY 2025, AM**

INSTRUCTIONS:

1. This paper consists of **Three (3)** questions.
2. Answer **ALL (3)** questions.
3. All working must be shown clearly on how you arrived at the answer.
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 booklets.
7. The following information may be useful:
   (a) Acceleration due to gravity, (g) = 9.8 m/s^2
   (b) Pie, $\pi = 3.14$
   (c) Specific heat capacity of copper calorimeter $C_C = 400 Jkg^{-1}°C^{-1}$
   (d) Specific heat capacity of brass $C_S = 380 Jkg^{-1}°C^{-1}$

1. The aim of this is to determine the coefficient of rigidity (shear modulus) of the wire provided. Proceeds as follows
   (a) Measure the length of the wire L = 90cm and suspend the pendulum bob as shown in figure

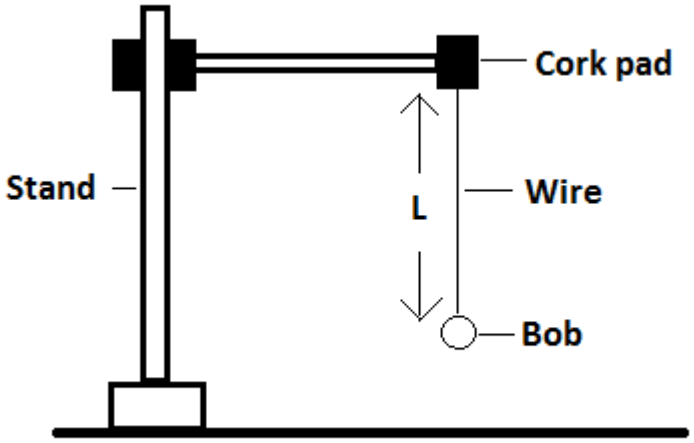

Figure 1

   1 below
   (b) Twist the bob in a small angular displacement so as to give a wire a shear strain and release it. Record the time for 20 vibrations hence determine the periodic time T (s).
   (c) Repeat procedure in (b) above for $L = 80cm, 70cm, 60cm, 50cm, 40cm$. Tabulate your results for L(m), t(s), T(s) and $T^2(s^2)$
   (d) Measure mass M and radius r of the bob using the micrometer screw gauge provided.

   QUESTIONS

   i. Plot a graph of $T^2(s^2)$ against L(m)
   ii. Find the slope(S) of the graph
   iii. Given$T^2 = \frac{8\pi IL}{\eta a^4}$, where$I = 0.4Mr^2$, a = radius of the wire. Determine the coefficient of rigidity (η) of the wire
   iv. State two sources of errors

2. You are required to determine the specific heat capacity of a liquid L by the method of mixture. Proceeds as follows:
   (a) Set up the apparatus as shown in figure 2 below

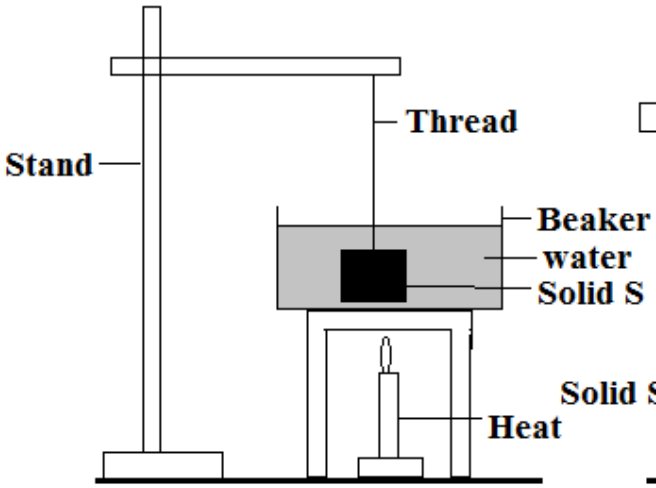

Figure 2a

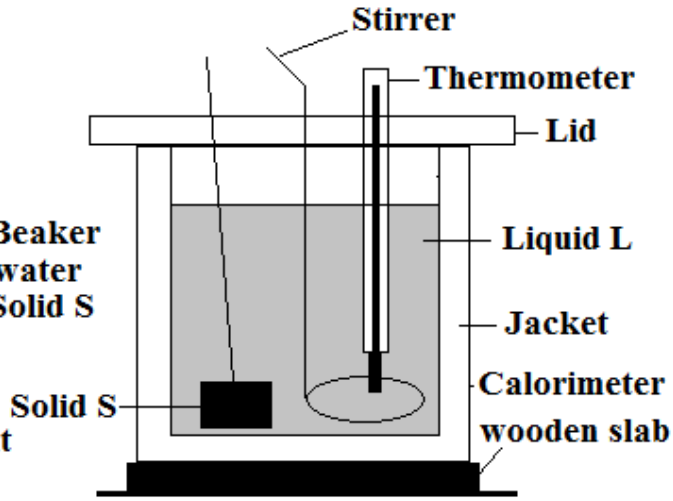

Figure 2b

   (b) Heat up the solid S in beaker containing water to about100℃. Use a piece of thread to suspend the solid from the retort stand as show in figure 2a
   (c) Meanwhile,
      (i) Determine the mass M_C of the calorimeter when empty and when two-third filled with cold liquid L, then calculate mass of cold liquid LM_L.
      (ii) Place the calorimeter two-third filled with cold liquid L in the jacket. Measure the initial temperature of the cold liquid L θ_O.
      (iii) Quickly transfer the solid S into the calorimeter and cover it with a lid to minimize heat losses as indicated in figure 2b, stir well and record the equilibrium temperatureθ_1.
      (iv) Remove the solid S from the calorimeter and measure its mass M_S
   (d) Apply the method of mixture show that the specific heat capacity $C_L$of the liquid L is given by $C_L = \frac{M_S C_S(\theta_2-\theta_1)-M_C C_C(\theta_1-\theta_O)}{M_L(\theta_1-\theta_O)}$, Calculate the value of C_L, where $\theta_2 =$ $temperature\ of\ boiling\ water$ 100℃
   (e) State two possible sources of errors in this experiment and how to minimize it.

3. You are provided with a cell E, the key K, the resistance box R, ammeter A and the voltmeter V. Proceed as follows.
   (a) Set up the circuit as shown in figure 3 below

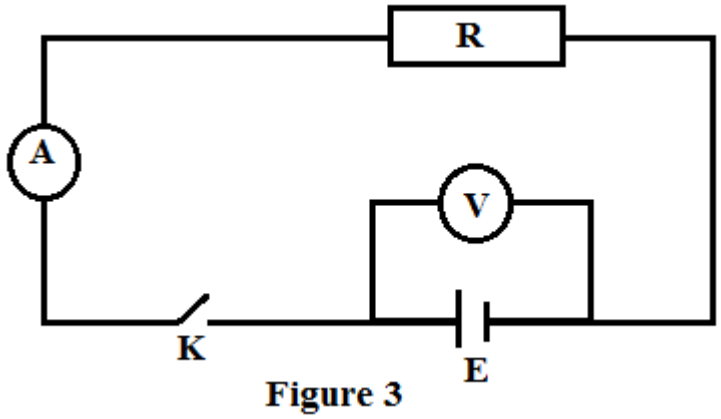

Figure 3

   (b) With the key open, observe and record the reading E on the voltmeter
   (c) Set the resistance $R = 7\Omega$, close the key and then record the reading of the current I flowing through the circuit and the potential difference V across the cell
   (d) Repeat the procedure in (c) above with$R = 5\Omega, 4\Omega, 2\Omega \; and \; 1\Omega$. For each case, record the corresponding value of I and V

   QUESTIONS

   i. Prepare a table of results including I(A), V(V) and (E-V)(V)
   ii. Plot a graph of (E-V) in volts against I in amperes
   iii. Compute the slope of the graph plotted in (ii)
   iv. What is the physical meaning of the slope in (iii)
   v. State one source of error and its precaution