THE UNIVERSITY OF ZAMBIA

IN ASSOCIATION WITH

THE TECHNICAL AND VOCATIONAL TEACHERS' COLLEGE

DECEMBER 2022 FINAL EXAMINATION

PHYSICS PRACTICAL (PH 335) QUESTION PAPER

STUDENT NUMBER: _____

DURATION: TWO HOURS **TOTAL MARKS**: 40

INSTRUCTIONS

1. Write your **student number only** (in legible handwriting) in the space provided above.
2. The paper contains two questions. Answer both questions.
3. Each question carries equal marks. The number of marks is given in brackets [ ] at the end of each question or part question.
4. This question paper will also serve as an answer sheet. Record your answers in the spaces provided in this question paper.
5. Show clearly all the necessary calculations because you may lose marks if you do not show your working or if you do not use appropriate units.
6. You will be allowed to work with the apparatus for a maximum of one hour for each question.
7. Electronic calculators may be used.
8. Additional answer paper and graph paper should be used only if it becomes necessary to do so.

FOR EXAMINER'S USE		
	EXAMINER	**MODERATOR**
1		
2		
TOTAL (/40)		
TOTAL (/100%)		

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

For Examiner's Use

Question 1

In this experiment, you will investigate a system in equilibrium due to several turning forces.

a. Measure and record the distance L between the two holes or marks in the wooden strip as shown in Fig. 1.1.

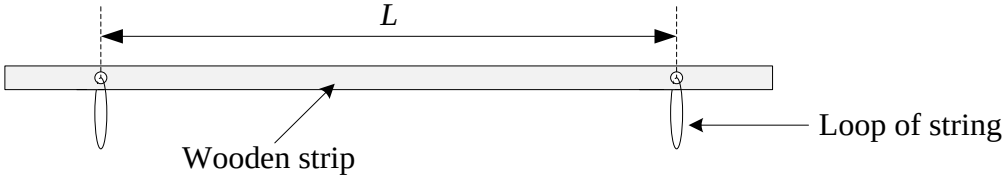

Fig. 1.1.

L = _____ m [1]

b. Write down the mass M on the card given to you.

M = _____ kg [1]

c.

i. Set up the apparatus as shown in Fig. 1.2, with mass m = 0.050 kg (note that this value might be slightly different from the one you will use).

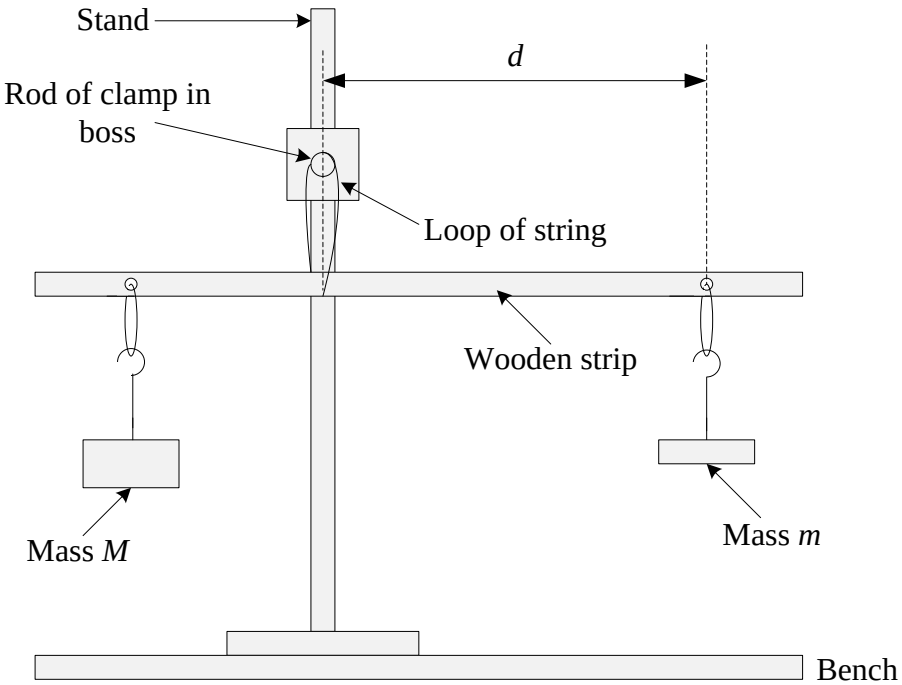

Fig. 1.2.

For Examiner's Use

ii. Adjust the position of the wooden strip until it balances. Measure and record the distance *d*, as shown in Fig. 1.2.

d = _____ m [1]

d. Vary *m* and repeat **(c)(ii)** until you have six sets of readings of *m* and *d*. Include values of $\frac{1}{d}$ in your table.

[7]

e. Plot a graph of $\frac{1}{d}$ on the *y*-axis against *m* on the *x*-axis. [3]

For Examiner's Use

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f.

i. Draw the straight line of best fit. [1]

ii. Determine the gradient and y intercept of this line.

Gradient = _____ [3]

y-intercept = _____ [1]

g. The quantities d and m are related by the equation

$$\frac{1}{d} = Pm + Q$$

where P and Q are constants.

Using your answers from **(f)(ii)**, determine the values of P and Q. Give appropriate units.

P = _____ [1]

Q = _____ [1]

Question 2

For Examiner's Use

In this experiment, you will investigate how the cooling rate of a hot liquid depends on the surface area of the liquid exposed to air.

a.

i. Pour cold water into the beaker up to the 200 ml mark.

ii. Pour the water into the beaker (or container) labelled 'S' and use the marker to place a mark on the surface of the beaker, level with the water surface.

iii. Repeat **(a)(i)**, **(a)(ii)** and **(a)(iii)** for the beaker (or container) labelled 'B'.

b.

i. Pour boiling water into beaker S up to the mark.

ii. When the temperature of the water falls to approximately 75 °C, start the stopwatch. Record this starting temperature θ_0.

θ_0 = _____ [1]

iii. After two minutes, measure and record the temperature θ.

θ = _____ [1]

iv. Calculate the change in temperature $\Delta\theta = \theta_0 - \theta)$.

$\Delta\theta$ = _____ [1]

c. Measure and record the diameter d of the water surface.

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d = _____ [1]

d. Repeat **(b)** and **(c)** for beaker B.

θ_0 = _____ [1]

θ = _____ [1]

$\Delta\theta$ = _____ [1]

d = _____ [1]

e. It is suggested that the relationship between $\Delta\theta$ and d is

$$\Delta\theta = kd^2$$

where k is a constant.

For Examiner's Use

i. Using your data, calculate two values of k.

First value of k = _____ [1]

Second value of k = _____ [1]

ii. Explain whether your results in **(e)(i)** support the suggested relationship.

[2]

f.

i. Describe **four** sources of uncertainty or limitations of the procedure for this experiment.

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[4]

ii. Describe **four** improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

[4]

END OF EXAMINATION