

**SIR ARTHUR LEWIS COMMUNITY COLLEGE
SCIENCE, TECHNOLOGY, INNOVATION AND SUSTAINABILITY**

**2024 – 2025 ACADEMIC YEAR - SEMESTER I
END OF SEMESTER EXAMINATION**

COURSE TITLE : **INTRODUCTORY PHYSICS**

COURSE CODE : **PHY102**

LECTURER : **BRANDON SCOTT**

DATE : **Wednesday 11th December 2024**

TIME : **1.00 – 3.00 PM**

DURATION : **2 HRS**

STUDENT ID# :

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Write your student's ID number on all the work you hand in.
2. This paper consist of five (5) questions, ***answer all questions***. Write the solutions on the answer sheet/s graph paper/s provided.
3. Ensure that units are included in all working and final answers where appropriate.
4. The use of a scientific calculator is permitted. ***No graphing calculators are allowed.***
5. A maximum of six (6) decimal places should be reported in working where needed. However, **report all final answers** to an appropriate number of significant figures.
6. All graphs should be drawn with a pencil and labels should be written in pen.
7. Do not use correction fluid.
8. Maximum Score: 40 marks.

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

Constants:

1.

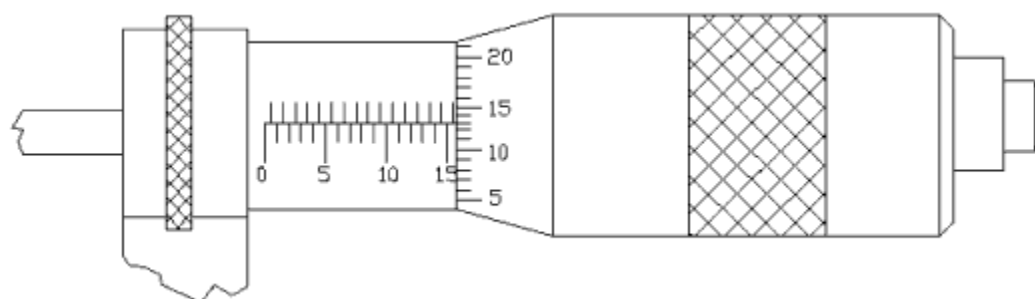


Figure 1.1

- a. State the reading on the micrometer screw gauge shown in Figure 1.1, showing your reading for each scale. (3 marks)
- b. A student measured the outer diameter of a precision ball bearing using this micrometer:

Measurement 1: 12.86 mm

Measurement 2: 12.87 mm

Measurement 3: 12.84 mm

The true diameter from manufacturer specifications is 12.50 mm. Explain how these measurements demonstrate both good precision and poor accuracy, using quantitative evidence. (2 marks)

- c. The dimensions of a cylindrical metal tube were measured as follows:

Diameter, $D = (12.486 \pm 0.015)$ mmLength, $L = (25.642 \pm 0.012)$ mm

- i. Determine the percentage uncertainty in D . (2 marks)
- ii. The volume of metal in the tube is given by

$$V = (\pi/4)(D^2)L$$

Calculate the percentage uncertainty in the final volume. Show your working clearly. (3 marks)

Total 10 marks

2. In an experiment, the viscosity, η , of a liquid is determined in terms of the volume, v , passing per second through a capillary tube of radius, r , and length, l , under a pressure difference p , where

$$\eta = \frac{\pi p r^4}{8 l v}$$

Assuming the given equation to be homogeneous, determine the dimensions of η . (5 marks)

Total: 5 marks

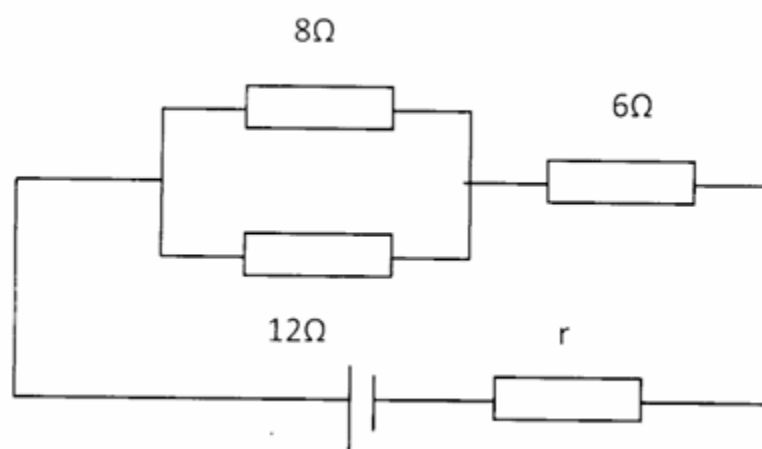
3. In a fast spinning circus ride, a person with a mass 68 kg rotates in a vertical circle of radius 7.8 m. The period of revolution is 4.8 s.
- Calculate the tension in the steam beams supporting the seat of a person when they are:
 - At the top of the circle. (4 marks)
 - At the bottom of the circle. (2 marks)
 - Calculate the RPM of the ferris wheel. (2 marks)
 - Calculate the frequency of the ferris wheel. (1 mark)

Total: 9 marks

4. A metal string of length 32.8 cm is mounted to two fixed rods.
- When the string vibrates in its fundamental mode:
 - Calculate the wavelength, (2 marks)
 - If the wave speed in string A is 275 m/s, determine its fundamental frequency, (2 marks)
 - The string is now excited with all possible harmonics up to 3000 Hz. Calculate the highest harmonic number possible (2 marks)

Total: 6 marks

5. A battery of e.m.f. 18 V and internal resistance r is connected to a network of resistors having two resistors in parallel ($8\ \Omega$ and $12\ \Omega$) in series with a $6\ \Omega$ resistor as shown:



If the total current in the circuit is 1.5 A, calculate:

- The total resistance of the resistors (circuit load). (3 marks)
- The internal resistance of the battery. (3 marks)
- The current in the $12\ \Omega$ resistor. (2 marks)

Total: 8 marks

END OF EXAMINATION