

KIBIBI SECONDARY SCHOOL
ACTIVITY OF INTEGRATION ONE

PHYSICS 1 S.5

TIME 1HR 15MINS

INSTRUCTIONS

Attempt all questions

ITEM ONE

In a laboratory, a Platinum Resistance Thermometer (PRT) is being calibrated and used to measure temperature. The thermometer has a resistance of **100.00 Ω** at the **ice point (0°C)** and **138.50 Ω** at the **steam point (100°C)** under standard atmospheric pressure. It is assumed that resistance varies linearly with temperature over this range. Later, the thermometer is used to measure the temperature of a heated metal block, and the resistance recorded is **109.73 Ω** . At the same time, a **Type K thermocouple** placed at the same position reads a temperature of **24.5°C**

TASK

- a) Using the resistance values at the ice and steam points, derive the linear relationship between resistance and temperature for the platinum resistance thermometer.
- b) Using the equation obtained, calculate the temperature (in $^{\circ}\text{C}$) corresponding to the resistance value of **109.73 Ω** .
- c) The thermocouple reads **24.5°C** under the same conditions. What is the difference between the readings of the PRT and the thermocouple?
- d) Discuss **two possible reasons** why the PRT and thermocouple might show different temperature readings even when placed at the same location.

ITEM TWO

In a physics laboratory, three blocks are connected by light, inextensible strings over a frictionless pulley system. Block A of mass **5 kg** lies on a **horizontal rough surface** ($\mu = 0.3$), connected to Block B (3 kg) hanging vertically on one side, and Block C (2 kg) hanging on the other side of the pulley. The pulley is smooth and the strings are ideal.

Before solving the system, your instructor asks you to explain **why friction exists at the molecular level**, and how **Newton's laws of motion** can be used to both analyze this system and derive fundamental relationships like **impulse**.

Task:

- a) Explain, from a molecular perspective, why **solid friction** exists between two surfaces.
- b) Why is the force of friction dependent on the **normal force** but **independent of surface area** (ideally)?
- c) Use **Newton's Second Law** to derive the formula for **impulse** and state its units.
- d) **Determine the acceleration** of the system and the **tension** in the strings.

END