SSEMU SECONDARY SCHOOL
SENIOR FIVE – END OF TERM I, 2026
PHYSICS (Competence-Based Assessment)
Physics Department -Mr. Travor Colletta
Time: 2 Hours 30 Minutes

Instructions to candidates: Answer all items.
Each item carries 20 marks.
Show all necessary working and reasoning.
Use clear diagrams where applicable.
Write your name, class, and index number in the spaces provided.

Item 1 (20 Marks)

A group of engineering students at a construction site are tasked with analyzing the motion of a loaded trolley being pulled across a slightly rough horizontal surface using two ropes. One rope is pulled by a worker at an angle of 30° to the horizontal, while another rope pulls at 45° in a different direction. The aim is to move the trolley efficiently while understanding how the forces combine to influence motion. The trolley has a mass of 50 kg and experiences friction as it moves.

Tasks:

a) Resolve the forces acting on the trolley into horizontal and vertical components. (Assume the tensions in the ropes are T_1 and T_2 respectively; draw a clear force diagram.)
b) Determine the resultant horizontal force acting on the trolley.
c) Calculate the acceleration of the trolley.
d) Explain how changing the angle of pulling affects the motion of the trolley.Item 2 (20 Marks)

Item 2 (20 scores)

During a science outreach program, learners visit a meteorological station where temperature measurements are critical for weather prediction. They observe a device that uses two different metals joined together to measure temperature differences when heated. The instructor explains that this device can generate an electromotive force when subjected to temperature changes, making it useful in harsh environments where ordinary thermometers may fail.Tasks:

a) Identify the thermometer described and state its principle of operation.
b) Explain how the device produces an electromotive force when heated.
c) Describe two advantages of this thermometer over liquid-in-glass thermometers.
d) Suggest one limitation of using this device in precise laboratory measurements.

Item 3 (20 Marks)

In a school laboratory, students are comparing different temperature measuring devices to determine which is most suitable for industrial applications. One group focuses on a thermocouple thermometer and investigates how temperature differences between two junctions influence its readings. They conduct experiments by heating one junction while keeping the other at a constant temperature.

Tasks:

a) Explain the working principle of a thermocouple thermometer.

b) Describe how the temperature difference affects the output of the device.

c) Sketch and label a simple thermocouple setup.

d) State two practical applications of thermocouples in industry.

Item 4 (20 Marks)

A team of students on internship at a water engineering company is tasked with determining the specific heat capacity of water using the continuous flow method. In their setup, water flows steadily through a heating coil where electrical energy is supplied. The students measure the temperature at the inlet and outlet, the mass flow rate, and the electrical power supplied, ensuring steady-state conditions are maintained throughout the experiment.

Tasks:

a) Describe the continuous flow method used in this experiment.

b) Derive an expression for the specific heat capacity of water using the quantities measured.

c) Explain why steady-state conditions are important in this experiment.

d) State two sources of error and how they can be minimized.

Item 5 (20 Marks)

While on a coastal navigation training program, students observe how sailors determine the position of a ship using a sextant. The device measures angles between celestial objects and the horizon using mirrors. Later in class, they relate this to reflection of light in plane and curved mirrors and explore how images are formed in different mirror systems.Tasks:

a) Explain the principle of reflection of light that enables the sextant to measure angles accurately. State the laws of reflection and describe how double reflection in the sextant works to determine the altitude of a celestial body.

b) With the aid of a ray diagram, show how the sextant (using two plane mirrors) doubles the angle between the horizon and a star.

c) Compare image formation in a plane mirror (as used in the sextant) with that in a concave mirror. State the characteristics of the images formed and one advantage of each type in optical instruments or navigation.

d) Suggest two other applications of plane or curved mirrors in everyday life or technology, and briefly explain how the curvature of a mirror affects the position and nature of the formed image.

End of Paper

DESIGNED BY MR. TRAVOR COLLETTA..

THE PHYSICS BEFORE ME IS VERY SIMPLE.