

**BOMBO ARMY SECONDARY SCHOOL**

**EXAMINATION BOARD**

**Uganda Upper Certificate of Education**

**S.5 PHYSICS ONE EOT II 2025**

**2 hours 30 minutes**

**INSTRUCTIONS TO CANDIDATES:**

This paper has two sections, SECTION A and SECTION B.

ATTEMPT ONLY TWO ITEMS FROM EACH SECTION (take  $g = 9.81\text{m/s}^2$ )

**SECTION A (MECHANICS)**

**ATTEMPT ONLY 2 ITEMS**

**ITEM 1**

During Christmas season, Mr. James decided to visit his village for the festivals. He chose to use his Subaru car where he started his journey by travelling at a speed of  $90\text{km/hr}$ . Since he never wanted to be late for the festival, he maintained this speed where he accidentally passed a stationary police car. When the policeman realized that the Subaru car was over speeding, he decided to chase it after 3 seconds it passed him by accelerating his car at  $4\text{m/s}^2$ . On catching him, the policeman tasked Mr. James to pay an over speeding fee of UGX 50,000 and also compensate for his fuel wasted during the run. The officer told him that his police car consumes 2 litres of fuel for every 50 metres covered and that 1 litre of fuel costs UGX 3000.

**TASK:**

Advise Mr. James on how to determine the total amount of money he has to pay to the police officer.

**ITEM 2**

- a. A football player of height 2.5 metres headed a ball with a velocity of 30m/s at an angle of  $45^\circ$  to the horizontal. Assuming the air resistance is negligible.

**TASK:**

- i. Define: Projectile Motion, Time of flight and Angle of projection.
  - ii. Calculate the maximum height covered by the ball above the ground.
  - iii. The velocity of the ball at the maximum height.
  - iv. The angle of impact on the horizontal ground.
- b. At a certain point, the ball reached the goalkeeper's hands and suddenly drops it vertically downwards from a height of 1.5 metres above the ground.

**TASK:**

- i. Determine the time it takes the ball to reach the ground before it is kicked by the goalkeeper.
- ii. The velocity with which the ball hits the ground with.

### ITEM 3

- a. A train is moving at a speed of 80km/h relative to the ground. A passenger on the train throws a ball straight up in the air. Assume the ball is caught by another passenger on the train:

#### TASK:

- i. Define; Relative velocity, and Relative path.
  - ii. Describe the path of the ball relative to a passenger who threw the ball.
  - iii. Describe the path of the ball relative to an observer standing on a platform watching the train go by.
  - iv. Calculate the velocity of the ball relative to the observer on the platform when it is at its highest point.
- b. At noon, boat A is 30km from boat B on a bearing of  $300^{\circ}$ . Boat A is moving in the north eastern direction at 16km/h while boat B is moving at 10km/h in the direction  $000^{\circ}$ . As the two boats were continuing to move with these constant velocities, the two captains realized that they were close to each other.

#### TASK:

Determine the minimum distance between the two boats at the instant the two captains realized that they were close to each other.

## SECTION B (HEAT)

### ATTEMPT ONLY 2 ITEMS

#### ITEM 4

- a. A digital thermometer is calibrated using two fixed points: the ice point ( $0^{\circ}$ ) and the steam point ( $100^{\circ}$ ). During calibration, the thermometer reads  $0.5^{\circ}\text{C}$  at the ice point and  $102^{\circ}\text{C}$  at the steam point.

#### TASK:

- i. Define; Steam point, Ice point and Trippl point.
  - ii. Calculate the correction factor for this thermometer
  - iii. If the thermometer reads  $50^{\circ}\text{C}$ , what was the actual temperature?
- b. A thermometer temperature gun (infrared thermometer) is used to measure the temperature of a hot object. If the gun has an emissivity setting of 0.95 and the object's actual temperature is  $200^{\circ}\text{C}$ .

#### TASK:

- i. Describe how a temperature gun (infrared) thermometer works.
- ii. What temperature will the gun read if it is set to an emissivity of 1.00?

## ITEM 5

Imagine you are a quality control engineer at a manufacturing plant in Uganda that produces temperature sensors for various industrial applications. Your team has developed a new thermocouple thermometer designed to measure temperatures accurately across a wide range. However, to ensure its reliability and precision, you need to calibrate it against a constant volume gas thermometer, which is considered standard for temperature measurements due to its high accuracy. You have been provided with the emf – temperature relationship of the thermocouple thermometer as:  $E_T = 50 + 0.17T + 3 \times 10^{-4} T^2$ , where  $E_T$  is the emf at temperature  $T$  in Degrees Celsius.

### TASK;

- Describe how your customers will use a thermocouple to measure an unknown temperature.
- Give two merits and demerits of a thermocouple thermometer.
- Using the above provided relationship for emf – temperature, find the temperature corresponding to  $60^\circ\text{C}$  as measured by the constant volume gas thermometer.
- Are the temperature in C above the same if not, explain the discrepancy.

END

# NO PHYSICS NO LIFE

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