

KOLOLO SENIOR SECONDARY SCHOOL

END OF TERM ONE ASSESSMENT 2025

S5 P510/1

PHYSICS PAPER ONE

2HOURS

Assume where necessary

➤ $g = 9.81 \text{ ms}^{-2}$

Attempt all

ITEM 1

You are an engineer working on a construction of a bridge. The bridge's support beams must be designed to withstand the forces acting on them without bending excessively. You need to determine whether the stress equation used in the design is dimensionally consistent.

- (a) Identify the fundamental and derived quantities involved in stress analysis.
- (b) Use dimensional analysis to verify the equation for stress;

$$\sigma = \frac{F}{A}$$

Where;

- **F** is applied force
 - **A** is cross-sectional area
 - **σ** is stress
- (c) Why is it important to ensure dimensional consistency in structural engineering?
 - (d) Discuss the problems incurred if an incorrect formula is used. How can the problems mentioned above be reduced or avoided?

ITEM 2

- (a) In preparation for installing a speed governor, a transport company decides to test a new bus on a straight stretch of road. The road has a clearly marked “(**maximum speed limit of 80 km/h**)”. The bus is fined UGX 50,000 if it exceeds the maximum speed limit by 1.5 ms^{-1} and it is charged UGX 100,000 if it exceeds the maximum speed limit by more than 1.5 ms^{-1} .

During the test:

- The bus starts from rest and accelerates uniformly at 1.6 m/s^2 for 15 seconds.
- It then travels at constant speed for 30 seconds.
- Finally, it decelerates uniformly to a stop over 10 seconds.

The students observing the test also record fuel use. The bus consumes 0.3 litres of fuel every 100 meters travelled. The cost of fuel is UGX 5,000 per litre.

The students are expected to analyze the bus' motion, check if the speed limit was respected, and evaluate how speed affects fuel consumption and transport costs. However, students don't know how to analyze the motion of the bus since they had not studied linear motion.

As an advanced level learner of physics who has studied motion,

- (i) Help the students to sketch a velocity-time graph for the motion of the bus described to be used to analyze the motion of the bus.
- (ii) Help the students to find out how much was the bus fined?
- (iii) Help the learners to determine the total cost of the fuel used during the test?
- (iv) How does a speed governor improve road safety?

ITEM 3

A student is playing basketball after school. She throws the ball towards the hoop from a distance of 4 metres. If she releases the ball from a height of 1.8 metres above the ground with an initial speed of 6 ms^{-1} at an angle of 45° to the horizontal.

Task

- a) How long does the ball stay in air before hitting the ground? (neglect air resistance)
- b) Determine how far the ball travels horizontally before landing
- c) What is the maximum height that the ball reaches above the ground?

ITEM 4

A technician uses a 5-meter-long wooden ladder to reach a security light mounted on a wall of a building. The ladder leans against a smooth wall, making an angle of 60° with the ground. The base of the ladder rests on a rough concrete surface to prevent slipping.

The ladder has a mass of 20 kg and is uniform. As the technician of mass 60kg climbs the ladder, there's a limit to how high he can go before the ladder begins to slip. The technician does not know how to determine how high he should climb before the ladder begins slip.

Task:**As a learner of physics who has studied statics;**

- (i) Help the technician to draw and label a diagram showing all the forces acting on the ladder.
- (ii) Help the technician to calculate how far up the ladder he can climb before it begins to slip.
- (iii) Explain the conditions required for the ladder to remain in equilibrium.
- (iv) Discuss how changing the angle of the ladder would affect the technician's safety.

END