

CENTRAL COLLEGE SCHOOL BULENGA

END OF TERM ONE 2026

S5 PHYSICS

TIME:2HOURS AND 30 MINUTES

Instructions: Attempt all items and diagrams should be in pencil.

ITEM 1

The display screens of digital devices use Light Emitting Diodes (LEDs), which emit high amounts of blue light. Scientific research has shown that long exposure to such light is harmful to the human eyes. An ICT student of senior five in a certain school is worried that their eyes may be at a risk due to continuous use of computers.

Support Material Provided:

- Wavelength of blue light = 450 nm
- Planck's constant, $h = 6.63 \times 10^{-34}$ Js.
- speed of light in vacuum, $c = 3.0 \times 10^8$ m/s
- Damage threshold for the human eye = 3.1 eV

Tasks:

- (a) Use the information provided to dispel fears of the student.
- (b) Explain to the student some of the symptoms of eye defects which can arise from prolonged exposure to radiations of energy beyond certain threshold.
- (c) Based on principles of Physics, suggest possible protective strategies which the student can employ to safeguard his/her eyes.

ITEM 2

At a small engineering workshop in Kampala, a group of students is designing a simple water pumping system powered by rotating motor. During testing, they notice that the power output P of the pump depends on the density of water, ρ , the speed of rotation N (revolutions per second), and the diameter of the pipe D .

The supervising engineer explains that instead of memorizing formulas, they can use dimensional analysis to derive the relationship between these quantities.

The students assume that:

$$P \propto \rho^a N^b D^c$$

Tasks

- a) As a physics student, find a formula for power in terms of ρ, N, D and justify the uses of dimensions.

ITEM 3

At a construction site in Kampala, a team of engineers is working on a high-rise building. During safety testing, a worker accidentally drops a metal bolt from the top floor of the building, which is 45m above the ground.

At the same moment, another worker in a lifting platform (elevator cage) is moving upwards at a constant velocity of 6m/s from a point 10m above the ground.

To avoid danger, the engineers want to determine whether the moving platform worker is at risk of being hit by the falling bolt.

Take acceleration due to gravity $g=9.8 \text{ m/s}^2$

Tasks

Justify whether the bolt will hit the worker in the moving platform.

ITEM 4

At central College Secondary School laboratory, students are carrying out experiments on electrostatics during a stormy season.

They rubbed a plastic rod with a dry cloth, after which the rod attracts small pieces of paper. The teacher explained that this is due to charging by friction and also demonstrates how a nearby neutral metal sphere becomes charged by induction when the rod is brought close without contact.

Later, during a thunderstorm, the school's lightning conductor is observed to glow faintly at its sharp tip. The teacher links this to action at sharp points, explaining how it helps protect the building by slowly leaking charge to the air.

In a further experiment, three small charged spheres A, B, and C are placed along a straight horizontal line. Their charges and positions are:

$$q_A = +4.0\mu\text{C}$$

$$q_B = -2.0\mu\text{C}$$

$$q_C = +3.0\mu\text{C}$$

Distances

$$AB=0.2\text{m}$$

$BC=0.3\text{m}$

Task

As a physics student, justify the behavior observed in the experiments determine the net force acting on charge B.

END