HeLP SEMINAR $7^{th} - JULY - 2025$

535/1 PHYSICS PAPER 1

DURATION: 2 Hours

INSTRUCTIONS TO CANDIDATES:

- This paper consists of two sections; A and B. It has a total of six examination items.
- Section A has two compulsory items.
- Section B has two parts; I and II. Answer one item from each part.
- Answer only four (4) items in all.
- Any additional items answered will not be scored.
- Answers to all items must be written in the answer sheet(s) provided.
- Graph paper is provided.

SECTION A

Answer all the items from this section.

Item 1

1. A certain construction company built a theatre near a hospital. In this theatre, they installed blue and red coloured lights and a speaker at the front. The management also intends to install mirrors in the changing rooms though still puzzled over which choice to make.

   One evening, two friends agreed to attend a show organised in the theatre and they came with one dressed in a yellow dress and the other in a cyan dress. When they entered, they both sat in front close to the speaker and wondered how long the back wall was from where they were seated. Still, while inside the theatre, they noticed that colours of their clothes kept changing and that there was a second sound similar to the one produced from the speaker which was heard after an interval of time. These made them confused.

   Hint: Speed of sound in air is 330 m/s.

   Task: As a student of Physics,

   (a) Advise the management of the theatre on how to ensure that the hospital is not disturbed by the noise from the theatre.

(b) Which type of mirrors would you advise the management to install in the changing rooms? State reasons for your response.

(c) Explain to the two friends why their clothes were changing colour.

(d) Help the two friends determine how far they were seated from the back wall if they heard the second sound after 0.1 seconds.

Item 2

An elder in a certain village was narrating to his family members his experience of a visit to London. He said that in London, daytime was longer than night time with 16 hours of day and 8 hours of night, this was unique to family. He also added that stars were rare organisms that died at day time and resurrected at night. Furthermore, he stated that the shape of the moon kept changing over a month's cycle.

The family members, in comparison, said that some of the elder's experiences were equally observed in their village but unfortunately did not understand these occurrences.

Task: As a student of Physics, help the elder and his family to understand;

(a) How the unique observation in London came about?

(b) The observation of stars at day and night time.

(c) Why and how the shape of the moon keeps on changing over that period?

SECTION B

PART I (Answer one item from this part)

Item 3

A business lady operates a restaurant which serves food and drinks. In the morning as she was driving her car to her restaurant, it developed a problem. There was a lot of steam coming from the bonnet and the engine stopped working. The mechanic she invited told her that the engine had overheated because there was little water in the radiator. After filling the radiator with water, the car started working.

When she reached her restaurant, she prepared 0.02 kg ice cubes at $-10°C$ for customers who wish to add them to their drinks. She then steamed the matooke for lunch and proceeded to make her special drink that she serves out in plastic glasses that hold 0.5 kg of the drink.

Hint:

Specific heat capacity of water is 4200 J/kg·K.

Specific latent heat of fusion of ice is 336000 J/kg.

Task:

(a) Understand the features that make her car radiator efficient for its purpose.

(b) Identify the various states of water that she used that day.

(c) Explain why each of the states of water works very well for the purpose it served that day.

(d) Determine the specific heat capacity of the special drink, given that a customer needed four ice cubes to reduce the temperature from 30°C to 10°C.

Item 4

A certain factory, which purifies salt-water of density 1050 kg/m^3 to become pure-drinking-water of density 1000 kg/m^3, has a water-tank truck of mass 5000 kg which transports salt-water from Lake Katwe to the factory.

At the entrance to the factory, there is a straight slope/incline of height 5 metres and the truck, carrying salt-water, is expected to move from the bottom to the top of this slope at a constant speed of 20 m/s in exactly 10 seconds.

The truck's water-tank is cylindrical with a radius of 1.4 metres and is full of salt-water. The capacity of the tank is 15,400 litres.

Hint:

- Acceleration due to gravity, $g = 10$ m/s^2
- Neglect any energy losses due to friction during the truck's motion
- Take $\pi = 3.14$

Task: As a learner of physics, determine:

(a) The increase in potential energy of the salt-water in the tank from the bottom to the top of the slope.

(b) The power exerted by the truck's engine to lift the salt-water up the slope.

(c) The pressure at the bottom of the salt-water in the tank.

(d) The length of the slope/incline.

PART II (Answer one item from this part)

Item 5

A school recently procured a commercial water purification machine that uses direct current. The electricity supplied to the school is alternating current at 13 kV with a current of 0.05 A. It is changed to 240 V by a process that is 80% efficient. The learners

are however puzzled if the machine will work since they don't understand how the voltage will be changed and if the machine will work.

Using your knowledge of Physics:

(a) Explain to the learners how the voltage is changed.

(b) Help the learners understand how the machine that uses direct current is able to work when the current supplied is alternating current.

(c) Determine if the machine will work given that it operates efficiently when current supplied is between 2 A to 3 A.

Item 6

A household with various appliances (2900 W cooker used for 3 hours daily, 10 lights of 40 W each used for 8 hours daily, and a 2900 W water heater used for 2 hours daily) is connected to a 240 V mains supply. The owner was discouraged from connecting the sockets in series by an electrician who also emphasized earthing of the same sockets. The owner also intends to spend only **UGX 70,000/=** on electricity weekly.

Hint: 1 unit of electricity costs UGX 900.

Task: Using your knowledge of Physics,

(a) Explain why the electrician made the recommendations above.

(b) Determine if the amount budgeted for is sufficient.

(c) Identify ways of reducing the electricity bill.

END

SUCCESS