UGANDA CERTIFICATE OF EDUCTAION

PHYSICS THEORY

PAPER ONE

2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES:

- This paper consists of **two** sections **A** and **B** it has seven items.
- Section **A has three compulsory items**
- Section **B** has two parts; **I** and **II**. Answer **one item** from each part
- Any additional items answered will not be scored.
- Begin each item on a new page.

SECTION A

Item 1

During swimming competitions in a certain school, John who watched the game as it progressed got excited upon seeing his friend winning the competitions. As he was celebrating for the victory his phone incidentally fell in the swimming pool and screamed loudly. He tried to bend down so that he could remove it from the swimming pool unfortunately his hand could not reach it. He wondered why he could it picked the phone yet it looked to be nearer to the water surface. He again got confused when he heard himself twice after 0.2s.

Hint

Speed of sound in air is 330ms-1

Task:

As a learner of physics help John:

a) To understand why the hand did not reach the phone
b) Explain to him why he heard himself twice and what could be done to avoid such incidences in cinema halls
c) To estimate how far are the washrooms from where he was while screaming loudly assuming there were no other buildings nearby.

Item 2

The national water and sewerage cooperation is faced with a challenge that the volume of water received at the distribution substation is less than that which is pumped from the main station. This is indicative of a leakage. The water is transported via underground water pipes and this problem has to be solved as fast as possible, otherwise there would be a water shortage and breakdown of equipment at the substation. One of the students suggested that the leakage can be located by use of a radioisotope. The radioisotope has an activity of 3800 counts per minute at the start and a half-life of 2 hours. The water is safe for use to human life if the activity is less than 240 counts per minute.

Task;

As a student of physics;

(a) Explain how the leakage can be located.
(b) Explain why precautions must be taken while working with the radioisotopes
(c) Find out whether the water would be safe for use after 16 hours.
(d) State the precautions which must be undertaken while handling the radioisotopes.

Item 3

In a certain country, a Television (TV) reporter was reporting live near the ocean about the high tides during night time. Viewers in another country were watching the live broadcast of the news bulletin during day time. The viewers wondered how it could be day and night at the same time, and how the event in one country could be watched live on TV in another country. In the same

broadcast, the reporter also commented on the relevancy of the International Space Stations to the world and encouraged countries in the world to participate in building them.

Task

Using your knowledge of physics, help the viewers to understand;

(a) The possibility of it being day in one place and night in another place.

(b) The occurrence of high ocean tides.

(c) How an event in one place can be broadcast live in another country.

(d) Why government of your country should build an international space station.

SECTION B

PART I

Answer **one item** from this part

Item 4:

A tour guide was tasked to direct tourists through the game park and he was to be paid Ugx. 22,000 per kilometer. He decided to make use of the tourist van which he started from the reception and headed into the game park. He accelerated to a speed of $15ms^{-1}$ in 30 seconds. He maintained the speed for 120 seconds. As he was driving, he then noticed that one of the tourists had opened the roof top and brought the van to a rest in 10 seconds at a rate of 1.5 ms^{-2}. He found him taking a look at elephants that were walking in a swampy area. Another tourist saw antelopes running on the other side of the swamp and they were seen struggling to cross through unlike the elephants. The tourist was puzzled and turned to inquire from the guide.

Later, the guide drove off towards the camping site at a **constant speed** of $20ms^{-1}$ for 20 seconds. They had to prepare a meal for their lunch. The guide provided them with food in a saucepan all of which weigh 0.32kg and have an average specific heat capacity of $2500Jkg^{-1}K^{-1}$. A heater rated 250W is used to warm the saucepan and its contents at 15°C. They were supposed to serve the food at a temperature of 48°C so as to reduce the time spent at the camp.

Task;

As a physics learner help;

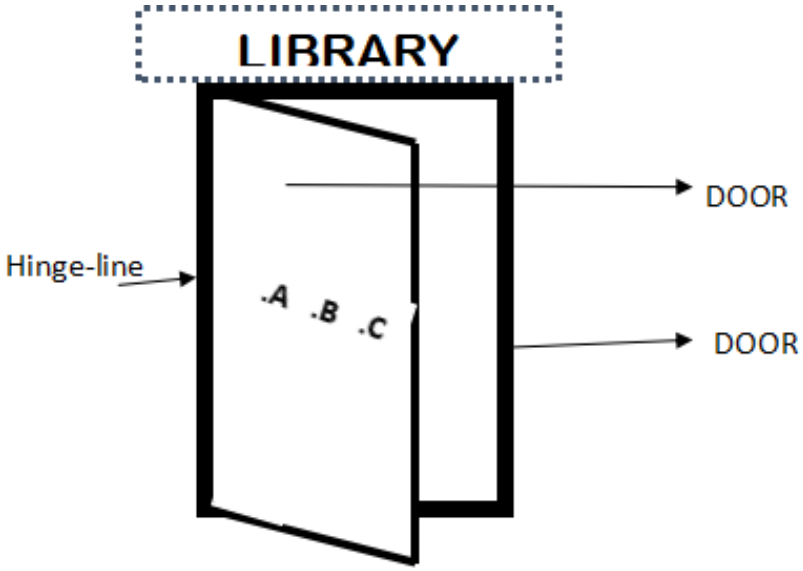
a) The guide to explain to the tourists why it was very easy for the elephants to walk through the swampy area than the antelopes.

b) The guide to determine how much he was to be paid for a single route from the reception to the camping site.

c) The tourists to know whether they will be able to serve the food within 2 minutes.

ITEM 5:

At **LEARN high school**, the door to the school library has a handle which is at a point B, **0.6m** away from the hinge line as shown below.



The librarian complains that opening the door requires a lot of effort /force, but the school engineer has kept a deaf ear.

Inside the library there are book shelves which on several occasions topple over when books are loaded in the upper sections. The librarian has also decided to decorate the library hall with black balloons, but she chose to hang them at a point that is always hit by direct sunshine. The prefect in charge of science and innovation says these balloons should not be put at that point.

TASK:

As a physics student,

i. Help the librarian understand the suitable position of the handle so that the librarian can use minimal/ little effort to open and close the door.

ii. Determine the resulting moment of force/turning effect if the librarian has been using an effort of **0.70N** to open/close this door.

iii. Explain to the school carpenter why those bookshelves topple when books are loaded to the upper section.

iv. Convince the librarian to change the position of the balloons.

PART II

Answer **one item** from this part

Item 6

A house hold with various appliances (a 3000W cooker used for 4hours a day, ten light bulbs each of rating 40W used for 8hours a day, a 2000W heater used for 30minutes a day) are connected to a 240V mains supply. The owner struggles to estimate the monthly budget and is uncertain about the compatibility of a 13A plug with the 240V mains.

The same home has got various complaints from the visitors who come to this home that they take so long knocking at the gate without immediate response from the people inside the house and this is because the house is a bit far from the main gate.

Hint: Each unit of electric power costs shs.600/=.

Task

a) Determine if 300,000/= will be enough for the monthly electricity bill.

b) Recommend whether the appliances should be connected in parallel or series for better functionality.

c) Determine if the cooker can utilize the mentioned 13A plug with the 240V mains supply.

d) Design an electromagnetic device that can be used in this home to solve the issue of visitors delaying at the gate.

Item 7

A community has started a project to generate electricity from a nearby water fall. They have installed a generator that produces 50,000 W of a.c. electricity at 500 V. They hope to transmit this electricity to the village that is 10 km away. They have erected the poles and connected the necessary wires all the way from the water fall to the village. The wires have a total resistance of 4W. The appliances the community hope to use work on 240 V. An engineer has advised the leaders in the project not to connect this power to the users directly because it will cause problems. The leaders have disagreed with the engineer, saying that he is using this as a trick to get more money from them, else they need clear explanations.

Task: Help the engineer to convince the leaders by;

(a) Explaining the problems that will arise if the electricity is used as it is directly from the generator.

(b) Determining the percentage power loss that is likely to occur along the way, when the power is transmitted directly as it is.

(c) Explaining the working of the device that must be installed in the distribution line to enable the community to use their appliances.

(d) Giving the advantages that the community is to attain by generating a.c. instead of d.c.

END