535/1

PHYSICS

Paper 1

July/ August, 2025

2hrs and 30 minutes

ALLIANCE

EXAMINATIONS BOARD

ALLIANCE EXAMINATIONS BOARD – 2025

Uganda Certificate of Education

Paper 1

Theory

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- This paper consists of two sections**;** **A** and **B**. It has seven examination items.
- Section **A** has three compulsory items.
- Section **B** has two parts**;** **I** and **II**. Answer one item from each part.
- Answer five items in all.
- Any additional item(s) answered will not be scored.
- All answers must be written in the booklets provided.

SECTION A

Answer all the items from this section

Item 1.

In a certain music concert that took place at night in a certain hotel on an Island, the artist played a guitar on a floating stage surrounded by disco lights flashing red, blue and green. The people in the audience were wearing yellow clothes with black spots on them. The audience was surprised about the new appearance of the colours of their clothes. The sound waves from the guitar travel through the air with a frequency of $\mathbf{440}\boldsymbol{Hz}$. The organizers also projected laser light, that travels through air with a frequency of 4.7× $\mathbf{10^8}$M$\boldsymbol{Hz}$ illuminating waves on the lake surface to aid visibility. The shores of the lake were $\mathbf{15}\boldsymbol{m}$ away from the hotel where performance was. Boys **A** and **B** standing on the lake shores in the same direction and in line with the playing music from the performance room in the hotel heard the sound at different intervals of time which attracted them to go and observe what was taking place at the Island. Boy **A** heard the sound after **3s** and boy **B** heard the sound after **4s.**

Hint:

$Speed\ of\ light\ in\ air = \mathbf{3.0} \times \mathbf{10^8}\boldsymbol{ms^{-1}}, Speed\ of\ sound\ in\ air = \mathbf{330}\boldsymbol{ms^{-1}}$

Task:

As a physics student;

(a) Help the two boys to understand why they heard the sound at different intervals.

(b) Clearly explain why the colour of the clothes of the audience kept on changing when coloured lights flashed on them.

(c) Why was laser source of light preferred to provide laser light that enhanced visibility late in the late hours of the night.

Item 2.

In a certain mine known for extracting copper and cobalt, as well as small amounts of uranium ore, the radioactive substance from the uranium ore had contaminated the stormwater runoff from the mines, which locals were unknowingly using for their daily needs. This led to a health crisis in the community as people started experiencing symptoms of radiation poisoning. To address the situation, the factory was closed as a team of scientists was called to investigate the situation. The initial concentration of the radioactive substance in the stormwater was measured to be 1000 millisieverts per liter.

Based on their research, the scientists discovered that the half-life of the radioactive substance was 50 years.

Hint:

➢ storm water will be safe for use if the concentration of the radioactive substance in the stormwater is less than 16 millisieverts per liter

Task:

As a learner of Physics, help the locals understand;

a) When the water will first be safe for consumption.

c) The potential health risks for the individuals who had been exposed to the contaminated water.

d) The safety precautions they should follow while dealing with those have been affected.

e) The impacts of the uranium ore contaminating the storm water runoff.

Item 3.

One of the most misunderstood branches of physics for years has been space physics (Astronomy). Some of the examples of such misunderstandings include the following.

- ✓ While watching the world cup which took place in Brazil in 2014 at 9:00 pm East African time, the football fans watching the game in E. Africa realized that it was still day time in Brazil, some of them were puzzled by this.
- ✓ The NASA (National Aeronautic and Spaced Administration) tells us that the only planet that supports life is earth.

TASK:

a) How can you explain the above statement in case one to your classmates, siblings or friends about the astronomical events in order to promote deeper understanding of physics in the school and community at large.

b) The solar system is composed of big, small and much smaller objects including planets. All planets move around the sun in elliptical paths. The motion is both rotational and revolution. Rotation motion involves the planets spinning about a fixed axis and revolution motion involves planet moving around the sun.

i) Help us to identify the other components of the solar system.

ii) Draw diagrams to show rotational motion and revolution motion

SECTION B

Part 1

Answer one item from this part

Item 4

A steel and tube industries company limited was contacted by the school to make a number of new items to restock their kitchen. Among the items on the invoice are; saucepan, strainer, saucepan covers (lids), ladles, cups and plates for students. The school did not specify the type of materials these items should be made of and therefore, the procurement officer of the company their raw materials supplier and the following was supplied following the invoice.

Plain sheets of copper Plain sheets of aluminum Clay Wood

 Melamine resin powder

For the production team to come up with the items requested by the school, they have to subject these raw materials to either heat or force however these materials behave differently under these two factors.

Support knowledge.

Heat capacity of copper is $400 Jkg^{-1}K^{-1}$

Heat capacity of aluminum is $900\ Jkg^{-1}K^{-1}$

Task

As a physics learner,

a) with reason(s) help the production team to select the raw material suitable for each item to be produced.
b) Explain at particle level how these materials behave when subjected to either heat or when a force is applied.

Item 5.

A pump is used to fill a tank by drawing water from underground well to be used at school power house. In order to minimize on power consumption its use for limited time, the pump works at a constant rate of $\mathbf{2.4\ x10^2 W}$ and it's able to raise 0.188 m^3 of water every minute through a height of 6m. The cooks complain that it is slow at work. At the power house the cook is always surprised because water pumped in the morning is always above the normal temperature at 30°C when measured using a thermometer which the cook

checks before making morning tea. The pump is said to be efficient if the ratio of its work out put to work input is above 0.75 and the cook boils 9.5l of water for morning tea and 500g evaporated.

Support materials

Density of water is $1000kgm^{-3}$

Specific heat capacity of water = $4200Jkg^{-1}K^{-1}$

Specific latent heat of vaporization of water $2.56 \times 106Jkg^{-1}$

Task.

(a) Obtain the rate at which the pump works in raising the water and comment on its efficiency.

(b) Explain to the cooks why water pumped in the morning has such temperature.

(c) How much heat is necessary to turn the lost volume of water into vapor.

PART II

Answer one item from this part.

Item 6.

In your neighborhood, a business man wanted to wire his house with power but he is confused on the different ways on how to make the electrical connections and installations. However, you are a S.4 physics student and you have been tasked to design a circuit for a project and you have been provided with three resistors with values of 5 Ω, 10 Ω and 2 Ω respectively.

TASK:

a) Advise the businessman the different ways of how to make the above different electrical connections with the help of the diagrams. (4 scores) ii) Give the businessman which one he can take and give the reason to why he could take it.

b) Explain how you would calculate the total resistance;
   i. When resistors are in series.
   ii. When 5 Ω resistor is in series with parallel connection of 10 Ω and 2 Ω.

Item 7.

In a certain place, a house was connected to a 240V mains voltage supply and the owner wished to connect a TV set rated 120V, 75W, a flat iron rated 120V, 600W, an electric bell of resistance 5 ohms that would instantly produce sound to alert the house owner about the visitors at the gate when a switch was pressed, and 4 bulbs rated 120V, 60W either in series or parallel connection for lighting purposes. The house owner also bought a Power King extension with a fuse rated 5A, where he plugged in his TV set and Flat iron. The T.V set is operated for 5 hours per day.

Task:

(a) Comment on the effectiveness of the fuse in the extension if it would support the above electrical appliances when plugged in the extension altogether.

(b) Assist the house owner to know in which way to connect his bulbs in the house and explain why?

(c) Explain how sound was produced when a switch was pressed.

(d) Determine the amount of money required to keep the T.V operating the whole day, if the electricity rate is Ugsh. 680 per kWh.

END